SUMMARY OF HYDROLOGIC AND CHEMICAL CHARACTERIZATION STUDIES VOLUME 1 OF 3 NAS FORT WORTH TX

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DRAFT REPORT

Summary of Hydrologic and Chemical Characterization Studies

Volume I

Prepared for:

U.S. Army Engineer District
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LIST OF ACRONYMS AND ABBREVIATIONS

AFP4	Air Force Plant 4
AOC	Areas of Concern
BSS	Base Service Station
CAFB	Carswell Air Force Base
cm/sec	centimeters per second
COC	chemicals of potential concern
CRP	Community Relations Plan
12DCE	1,2-dichloroethene
DNAPL	dense non-aqueous phase liquid
DOD	U.S. Department of Defense
DP12	Chrome Pit No. 3
DP13	Die Yard Chemical Pit
DPM	Defense Priority Model
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESE	Environmental Science & Engineering, Inc.
FAA	Federal Aviation Administration
FBOP	Federal Bureau of Prisons

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued, Page 2 of 5)

FDTA 1	Fire Department Training Area No. 1
FDTA 2	Fire Department Training Area No. 2
FFA	Federal Facilities Agreement
FFSA	Former Fuel Storage Area
FR	Federal Register
ft	foot
ft/ft	feet per foot
ft-bgs	feet below ground surface
ft-msl	feet above mean sea level
ft/day	feet per day
GD	General Dynamics
GOCO	government-owned/contractor-operated
gpd/ft	gallons per day per foot
gpd/ft^2	gallons per day per square foot
gpd	gallons per day
gpm	gallons per minute
HARM	Hazard Assessment Rating Methodology
HSWA	Hazardous and Solid Waste Amendments
IRM	interim remedial action
IRP	Installation Restoration Program

IRPIMS	Installation Restoration Program Information Management System
JETS	Jet Engine Test Stand
lb	pound
LF01	Landfill No. 1
LF02	Landfill No. 2
LF03	Landfill No. 3
LF04	Landfill No. 4
LF05	Landfill No. 5
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
NARF	Nuclear Aerospace Research Facility
NCP	National Oil and Hazardous Substances Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
NSI	no significant impact
OAC	other areas of concern
PA/SI	Preliminary Assessment/Site Inspection
PA/SI/RI	Preliminary Assessment/Site Inspection/Remedial Investigation
PCE	tetrachloroethene

pCi/L	picocuries per liter
POL	petroleum, oil and lubricant
PR	Preliminary Review
R-RAM	Radian Risk Assessment Model
RAM	radioactive material
RAP	remedial action plan
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RFA	RCRA Facility Assessment
RFI	Remedial Feasibility Investigation
RI/FS	remedial investigation/feasibility study
RI	remedial investigation
SARA	Superfund Amendments and Reauthorization Act of 1986
SCS	United States Soil Conservation Service
SOW	scope of work
SV	Sampling Visit
SWMU	solid waste management unit
TCE	trichloroethene
TMV	toxicity, mobility, and volume
TWC	Texas Water Commission

USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
UST	underground storage tank
VOC	volatile organic compound
VSI	Visual Site Inspection
WPAFB	Wright-Patterson Air Force Base
WSA	Weapons Storage Area
WWCB	Wastewater Collection Basins
yd^3	cubic yards
°F	Fahrenheit

1.0 INTRODUCTION

This draft report was prepared by Environmental Science & Engineering, Inc. (ESE) under the U.S. Army Corps of Engineers (USACE) Contract No. DACW63-93-D-001, Delivery Order No. 3. Delivery Order No. 3 is entitled "Feasibility Study and Recommendations for Remediation of the TCE Plume, Carswell AFB, Plant #4, Ft. Worth, TX" and consists of seven separate tasks. This report specifically addresses the requirements for Task 1 (Section 1.3).

This report specifically addresses the requirements for Task 1. The overall goal of Task 1 is to summarize all technical studies which were/are commissioned to develop hydrogeologic and/or chemical information for characterizing the extent, type, and concentration of groundwater contamination within and around the study area. The specific requirements for Task 1 are presented in Section 2.0 of this report. The following sections summarize the commissioned studies at Air Force Plant 4 (AFP4) and Carswell Air Force Base (CAFB).

1.1 SITE HISTORY--AFP4

AFP4, a government-owned/contractor-operated (GOCO) facility, is an aircraft manufacturing plant located in Tarrant County, Texas, 7 miles northwest of the City of Fort Worth. The facility has been in operation since 1942 and currently produces F-16 aircraft, radar units, and various aircraft and missile components.

Historically, the manufacturing processes at AFP4 have generated an estimated 5,500 to 6,000 tons of waste oils, solvents, paint residues, and spent process chemicals per year. These wastes were disposed of onsite by burial in landfills, burning, or discharge into pits or the sanitary sewer system. A waste treatment plant was constructed in the early 1970s to treat the process chemical solutions, rinse waters, and other waste waters, and solvents. Some wastes, such as paint residues and process cyanide solutions, were later disposed of offsite by a contractor, but waste oils and fuels continued to be disposed of in onsite landfills

or burned in fire training exercises. During the late 1970s, the burning of fuels for fire training was phased out, and all waste oils and recoverable solvents have since been disposed of offsite by a contractor. Currently, through waste minimization techniques, the offsite disposal of wastes is less than 2,500 tons per year.

Potential contamination at AFP4 was first noticed by a private citizen in September 1982. General Dynamics (GD) was notified and took immediate action. The source of the observed contamination was thought to be leachate from a landfill. In October 1982, GD began construction of French Drain No. 1 to prevent migration of contaminated groundwater toward Meandering Road Creek.

A subsurface investigation was initiated at AFP4 to determine the extent and source of contamination. The installation Phase I Investigation of Subsurface Conditions, conducted by Hargis & Montgomery, Inc., was completed by February 1983. The Phase I investigation confirmed the presence of groundwater contamination in the Upper Zone flow system. The contamination primarily consisted of metals and volatile organic compounds (VOCs) [trichloroethene (TCE), 1-2 trans dichloroethylene]. The investigation confirmed the presence of VOC contamination in the underlying Paluxy Formation aquifer and a possible breach in the confining layer between the Upper Zone flow system and the Paluxy Formation aquifer.

Since the recognition of initial contamination, the U.S. Department of Defense (DOD) has taken actions to locate and identify past disposal sites and to eliminate the resultant potential contaminant hazards to public health in an environmentally sound manner via the Installation Restoration Program (IRP) (Intellus, 1986). The IRP is a four-phase program, consisting of the following:

- Phase I--problem identification,
- Phase II--confirmation,

- Phase III--technology development, and
- Phase IV--planning and implementation of appropriate control measures.

The IRP for AFP4 was initiated in March 1984 with the completion of a Phase I records search. At the time of the records search, a total of 20 disposal sites was identified by the contractor performing the work. The identified sites were rated using the Hazard Assessment Rating Methodology (HARM). On October 15, 1984, AFP4 was proposed for inclusion on the National Priorities List (NPL) 49 Federal Register (FR) 40320. In December 1987, the U.S. Air Force (USAF), completed a Phase II Report Confirmation/Quantification Study which documents the presence of hazardous substances in soil and groundwater. On September 4, 1990, USAF, the U.S. Environmental Protection Agency (EPA) Region VI, and the Texas Water Commission (TWC) signed a Federal Facilities Agreement (FFA). Table 1.1-1 identifies information on the 21 FFA sites, 9 additional IRP sites (not included in the FFA), and 2 Areas of Concern (AOCs).

1.2 SITE HISTORY--CAFB

CAFB was selected for closure and associated property disposal during Round II Base Closure Commission deliberations. The base closed on October 31, 1993. However, within this report, the site will still be referred to as CAFB.

Wastes were generated and disposed of at CAFB since the beginning of industrial operations in 1942. Major industrial operations included maintenance of jet engines, aerospace groundwater equipment, fuel systems, weapon systems, and pneumatic systems; maintenance of general and special purpose vehicles; aircraft corrosion control; and nondestructive inspection activities. The generated wastes were primarily oils, lubricants, recoverable fuels, spent solvents, and cleaners.

No.	Site ID	Alias	Class	Description	Material Disposed of	Operation	Status	Mechanism
1	LF01		IRP Site	Landfill No. 1	Drums of unspecified liquid wastes, solvents, thinners, paint wastes, burned oils & fuels, rubble, plaster, lumber, suspected wastes include: magnesium wastes, chromate sludges, cyanide	1942-1966	In PA/SI process	CERCLA
2	LF02		IRP Site	Landfill No. 2	Construction rubble, plasters, lumber, tires	early 1940s-early 1960s	NFA Document 1990	Awaiting regulatory concurrence
3	LF03		IRP Site	Landfill No. 3	Hazardous liquid wastes of mixed oils & solvents fill dirt & rubble	1942-1945 1945-1966 inactive 1966-1977	PA/SI/RI/FS process	CERCLA
4	LF04		IRP Site	Landfill No. 4	Construction rubble, small quantities of solvents, oils fuels, thinners	1956-early 1980	Originally NFA Recommended/ PA/SI/RI/FS process	CERCLA
5	FT05	FDTA No. 2	IRP Site	Fire Department Training Area No. 2	Waste oils, fuels	1955-1956	PA/SI/RI/FS process	CERCLA
6	FT06	FDTA No. 3	IRP Site	Fire Department Training Area No. 3	Waste fuels, oils	mid 1960s	NFA Recommended	Awaiting regulatory concurrence
7	FT07	FDTA No. 4	IRP Site	Fire Department Training Area No. 4	Waste oils, fuels	late 1960s	NFA Recommended	Awaiting regulatory concurrence
8	FT08	FDTA No. 5	IRP Site	Fire Department Training Area No. 5	Waste fuels, oils unspecified chemicals	mid 1960s	PA/SI/RI/FS process	CERCLA
9	FT09	FDTA No. 6	IRP Site	Fire Department Training Area No. 6	Waste fuels, oils	late 1950s-1980	PA/SI/RI/FS process	CERCLA
10	DP10		IRP Site	Chrome Pit No. 1	Miscellaneous liquid and solid chemical waste, chrome waste	early 1940s	NFA Recommended 1990	Awaiting regulatory concurrence
11	DP11		IRP Site	Chrome Pit No. 2	Miscellaneous liquid & solid waste, chromate solutions	mid 1940s	NFA recommended 1990	Awaiting regulatory concurrence
12	DP12		IRP Site	Chrome Pit No. 3	Chromate, barium-chromate sludge, dilute metal solutions, drums of unidentified liquids	1957-1973	PA/SI/RI/FS process	CERCLA
13	DP13		IRP Site	Die Yard Chemical Pits	Chromate sludges, metal solutions, other chemical wastes	1956-1962	PA/SI/RI/FS process	CERCLA
14	SS14	FSA No. 1	IRP Site	Fuel Saturation Area No. 1	Fuels, JP-4	mid 1970s-early 1980s	PA/SI/RI/FS process	CERCLA

Table 1.1-1
Site Summary Table
For Air Force Plant 4

SOURCES: MAP, 1992.

The IRP was initiated at CAFB in 1984 and began with a program records search. IRP studies focused on identifying and characterizing waste disposal areas on the installation.

CAFB currently has 20 IRP sites. A Phase I records search conducted in 1984 identified 15 sites requiring further action. An additional five sites were identified since then through subsequent IRP investigations and other base activities. Thirteen of these sites are also Resource Conservation and Recovery Act (RCRA) solid waste management units (SWMUs). Table 1.2-1 provides a brief description of these sites.

The IRP was designed to identify, characterize and remediate any contamination discovered onsite. The original IRP program was divided into the following four phases, in remaining consistent with CERCLA investigation guidelines:

- Phase I: Problem Identification and Records Search,
- Phase II: Problem Confirmation and Quantification,
- Phase III: Technology Development, and
- Phase IV: Corrective Action.

Phase I is designed to review file material, perform site visits, and conduct interviews to provide the information for the assessment. Phase II is designed to confirm the presence or absence of contamination and provide the basis for selecting the appropriate types of remedial action. The results were published in February 1984.

1.2.1 PHASE I

During the Phase I records search, CH2M Hill identified 17 disposal and spill sites (designated IRP sites) at CAFB and 5 sites at the Weapons Storage Area. Several of these sites were determined not to have significant potential for adverse environmental consequences. The potential environmental consequences of the remaining 14 sites were evaluated using the U.S. Air Force HARM. This

Table 1.2-1 **Site Summary Table**
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Site No.	WIMS-ES Site ID	OU	Alias	Site Class	Site Title	Material Disposed of	Operation	Status	Regulatory Mechanism
1	LF01	2	SWMU 28	IRP Site	Landfill 1	Unknown	1942-1989	Analytical data suggests solvent and metal-bearing wastes. No significant risk. Under consideration for no further action	RCRA
2	LF02	N/A	N/A	IRP Site	Landfill 2	Construction rubble and materials	1952-1956	No action per RCRA Facility Assessment March 1989	RCRA
3	LF03	N/A	N/A	IRP Site	Landfill 3	Construction rubble, fill area and small amount of hazardous waste	1950-1952	No action per RCRA Facility Assessment March 1989	RCRA
4	LF04	1	SWMU 22	IRP Site	Landfill 4	Paint, thinners, strippers, cadmium batteries, waste solvents burned wastes	1956-1973	RD canceled December 1991	RCRA
5	LF05	1	SWMU 23	IRP Site	Landfill 5	All types of flightline waste and refuse. TCE regularly burned	1963-1975	RD canceled December 1991	RCRA
6	LF06	1	SWMU 62	IRP Site	Landfill 6	Construction rubble and possible drums of hydraulic fluid	1975-1978	RI	RCRA
10	WP07	1	SWMU 24	IRP Site	Waste Burial Area	Buried drums containing cleaning solvents and leaded sludge from flightline	1960s	RD canceled December 1991	RCRA
11	FT08	N/A	SWMU 18	IRP Site	Fire Training Area No. 1	Waste oils and fuels were burned	Prior 1963	NFA - 17 December 1991	RCRA
12	FT09	1	SWMU 19, 20, 21	IRP Site	Fire Training Area No. 2	Waste oils and solvents were burned. Unused JP-4 was observed	1963-1989	RA	RCRA

SOURCES: MAP, 1993; ESE.

Table 1.2-1 **Site Summary Table**
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Site No.	WIMS-ES Site ID	OU	Alias	Site Class	Site Title	Material Disposed of	Operation	Status	Regulatory Mechanism
13	SD10	1	SWMU 53	IRP Site	Flightline drainage ditch	Petroleum, aircraft soap and oils have migrated from flightline	Unknown construction date but used to present	RA	RCRA
14	WP11	N/A	N/A	IRP Site	Pesticide rinse area	Rinse water from pesticide spray equipment	Unknown start up date. No longer in use	No action per RCRA Facility Assessment - March 1989	RCRA
15	OT12	N/A	SWMU 63	IRP Site	Entomology dry well	Pesticide and herbicide contaminated rinse water	1965-1981	NFA - 17 December 1991	RCRA
16	SD13	2	SWMU 64, 67	IRP Site	Unnamed stream	Hydrocarbons	1965-Present	Focused RI	RCRA
17	ST14	1	SWMU 68	IRP Site	POL Tank Farm	JP-4	Early 1960s	RD	RCRA
N/A	OT15	3	SWMU 60	IRP Site	WSA	Radium	1957-1969	Being monitored. Programmed for IRA	RCRA
N/A	ST16	2	N/A	IRP Site	Base Service Station	Hydrocarbons	Early 1970s	RI/FS	CERCLA/ PST
N/A	OT18	1	N/A	IRP Site	Airfield groundwater	JP-4		RI	CERCLA
N/A	DP17	1	N/A	IRP Site	Waste oil dump	Oils, solvents, unknown		RI	CERCLA
N/A	OT15	N/A	SWMU 65	IRP Site	WSA disposal site	Waste cleaner, solvents, and thinners, TCE	Unknown	NFA - 17 June 1991	RCRA
N/A	N/A	2	N/A	IRP Site	East area groundwater	Metals and hydrocarbons, possible solvents		Unknown	RCRA

N/A = Not applicable.

SOURCES: MAP, 1993; ESE.

evaluation took into account such factors as potential receptors of contamination, the nature of waste, potential pathways for contaminant migration, and efforts to contain potential contamination. The following is a list of IRP sites in order of their HARM ranking:

1. Site #13--Flightline Drainage Ditch,
2. Site #12-- Fire Department Training Area No. 2 (FDTA 2),
3. Site #17--Petroleum, Oil and Lubricant (POL) Tank Farm,
4. Site #10--Waste Burial Area,
5. Site #16--Unnamed Stream,
6. Site #15--Entomology Dry Well,
7. Site #1--Landfill No. 1 (LF01),
8. Site #4--Landfill No. 4 (LF04),
9. Site #5--Landfill No. 5 (LF05),
10. Site #3--Landfill No. 3 (LF03),
11. Site #11--Fire Department Training Area No. 1 (FDTA 1), and
12. Weapons Storage Area,

The Base Service Station (BSS) was not included in the HARM rating because it was not designated an IRP site until completion of the Stage 1 investigation. Site Nos. 1, 13, 15, 16, and 17 were informally grouped as one into the East Area, whereas the remaining sites were grouped into the Flightline Area.

1.2.2 PHASE II--STAGE 1

The Phase II Stage 1 Confirmation/Quantification studies were designed to confirm the presence or absence of contamination, determine the extent and degree of contamination, and to provide the basis for selecting the appropriate type of remedial action. During this phase, groundwater, surface water, soil, and sediment samples were collected for laboratory analysis. Geologic profiles are determined through correlation of soil and rock samples. Stage 1 of the Phase II study was completed in October 1986. The following paragraphs summarize the major Stage 1 findings at each of the targeted IRP sites.

Site #13--Flightline Drainage Ditches

The analytical results of samples collected from the Flightline Drainage Ditch showed that the soils have been affected by runoff from the flight line. The investigation did not assess the groundwater quality.

Site #12--Fire Training Area 2

The analytical results indicated that the groundwater in the water table aquifer (Upper Zone) is impacted by halogenated and aromatic organic compounds. TCE concentrations downgradient of the site were significantly higher than those measured onsite.

Site #17--POL Tank Farm

The analytical results from groundwater samples collected from borings placed at the POL Tank Farm indicated that the Upper Zone is contaminated with organic compounds.

Site #10--Waste Burial Area

The proximity of the Waste Burial Area relative to LF04 and LF05 automatically indicated that the groundwater within the Upper Zone in that area was significantly impacted.

Site #16--Unnamed Stream

The results of the investigation at Site #16 showed significant organic contamination in the Upper Zone west of the inferred location of the French drain. Elevated levels of metals and some miscellaneous organic compounds were also detected.

Site #15--Entomology Dry Well

No groundwater impacts were detected at the Entomology Dry Well.

Site #1--LF01

The analytical results of the groundwater at LF01 were inconclusive.

Site #3--LF03

The hydrogeologic investigation revealed significant levels of contamination in the Upper Zone north of LF03. The study results showed that the Goodland/Walnut aquitard rocks may be eroded along the east side of AFP4 property to the point where its capability to inhibit the vertical exchange of groundwater between the Upper Zone and the Paluxy aquifer has been significantly reduced.

Site #4--LF04

The analytical results indicated that the Upper Zone groundwater within the Upper Zone along the east side of the landfill contained elevated levels of halogenated organic compounds.

Site #5--LF05

The groundwater within the Upper Zone showed elevated levels of halogenated organic compounds, including TCE, in upgradient and downgradient directions of the landfill. The stream to the north of the landfill showed elevated levels of vinyl chloride.

Site #11--FTA-1

Results of the Stage 1 investigation showed low levels of organic compounds in the groundwater of the Upper Zone. TCE was also discovered in the soil samples collected from the training area.

Weapons Storage Area

The investigation in the Weapons Storage Area did not include an analysis of the groundwater in the Upper Zone. Soil samples were collected for laboratory analysis from borings placed west of the Inspection Shop. Elevated levels of TCE

were detected in some of those samples. A sample collected from the potable water supply well contained elevated levels of radium.

If the results of the Phase II investigation revealed that no contamination existed which threatened human health or the environment, then the results were documented and no further action was taken at the site. The investigation at some sites may not detect the degree of contamination necessary to warrant costly remediation projects. The approach for such sites was generally a call for additional monitoring. Sites that were deemed to represent a significant threat typically proceeded to Phase IV. Phase III is designed to address those sites where additional testing and research may be needed before progressing to Phase IV. Phase IV is usually conducted in two stages. Phase IVA is a planning stage where a remedial action plan (RAP) is formulated. The RAP documents the development, evaluation, and selection of the best alternative to control the hazards posed by a waste disposal site. Phase IVB represents the implementation of the selected alternative, including the design, construction, and management.

Before any decisions were made regarding the results of the Stage 1 investigation, federal legislation was passed in the form of the Superfund Amendments and Reauthorization Act of 1986 (SARA). In response to SARA, the IRP was reorganized to incorporate the new terminology set forth by EPA and to integrate the new requirements of the National Oil and Hazardous Substances Contingency Plan (NCP). The result was the creation of three action stages:

1. Preliminary Assessment/Site Inspection (PA/SI)
2. Remedial Investigation/Feasibility Study (RI/FS)
3. Remedial Design/Remedial Action (RD/RA)

The PA portion of the first stage under the NCP is comparable to the original IRP Phase I and consists of a records search and interviews to determine whether potential problems exist. A brief SI that may include sampling of the

environmental media is performed to give an initial characterization or confirm the presence of contamination of a potential site. An RI is similar to the original Phase II and consists of additional field work and evaluations to assess the nature and extent of contamination. It includes a risk assessment and determines the need for site remediation. The original Phase IV was replaced by the FS and RD. The FS documents the development, evaluation, and selection of alternatives to remediate the site. The selected alternative is then designed (RD) and implemented (RA). The original Phase II portion of the IRP process is not included in the SARA process.

1.2.3 RI/FS--STAGE 2

The RI/FS (formerly Phase II) Stage 2 work was initiated in September 1987. The entire CAFB facility was targeted during the initial RI/FS Stage 2 investigation. The investigation included the performance of soil gas surveys, drilling of boreholes and installation of monitor wells in the Upper Zone material, collection of soil samples from boreholes, collection of sediment samples, and analysis of samples for a variety of inorganic and organic constituents. All data related to field activities and laboratory analyses performed for the Stage 2 investigation were incorporated into the Installation Restoration Program Information Management System (IRPIMS) database. These data are included in the text and appendices of this document and were provided to USAFOEHL in an Informal Technical Information Report after field activities were completed.

A baseline risk assessment was conducted to determine the potential carcinogenic risk associated with each CAFB IRP site, to characterize the potential for noncarcinogenic effects, and to use the results to rank and prioritize sites for remedial action. The methodology used in the baseline risk assessment involved several sequential steps to derive the values and assumptions necessary to calculate exposure, dose, and risk. The steps included selecting and characterizing indicator chemicals, estimating contaminant release rates,

evaluating exposure pathways, and developing exposure scenarios. These tasks produced inputs to a computerized risk assessment model, the Radian Risk Assessment Model (R-RAM), which calculated the pollutant-specific estimates of exposure, dose, and risk for direct and indirect routes of exposure. Exposure pathways which were not qualified were described qualitatively.

An additional goal of the Stage 2 investigation was the evaluation and screening of preliminary alternative remedial actions. Possible remedial actions were identified for each of the contaminated environmental media, including soil, groundwater, and surface water. Next, a preliminary screening process was conducted to identify a comprehensive set of available control measure technologies and select those that were applicable to the IRP sites. These technologies were then evaluated according to effectiveness and ease of implementation. Finally, these technologies were combined into site-specific alternatives to address the environmental conditions determined by the Stage 2 field and laboratory activities.

To determine the effects on the local groundwater systems, concentrations of organic and inorganic compounds detected in groundwater samples were compared to various water quality criteria. These criteria, from federal drinking water regulations, standards, and guidelines, include final and proposed maximum contaminant levels (MCLs) and proposed maximum contaminant level goals (MCLGs) above zero, established by EPA as part of national drinking water regulations. The MCLGs are nonenforceable health goals set, with an adequate margin of safety, at levels that would result in no known or anticipated adverse health effects. The MCLs are enforceable standards set at levels as close to the MCLGs as feasible.

In the absence of regulatory standards for some compounds, other human health criteria have been used for the interpretation of IRP data. Although these criteria do not now have the force of standards, they do provide a valid means of

assessing the relative degree of contamination. Using human health criteria and standards is a stringent way to evaluate groundwater contamination at CAFB. Since the Upper Zone is not used as a drinking water supply source, in situ contaminants in this unit have neither human health nor environmental consequences. Groundwater in the Paluxy Formation, however, is issued directly as a drinking water source.

The results of the RI/FS Stage 2 investigation for the entire base were submitted in April 1989. This report documented that the areas of subsurface contamination at CAFB are focused in the Flightline Area sites, the POL Tank Farm, and the BSS. The extent of the TCE plume associated with LF04 and LF05 and the Waste Burial Area has not been completely defined upgradient (west) or downgradient (north and east) of these sites. Since shallow groundwater flow is generally west to east, the existence of TCE west of IRP sites indicates an additional upgradient TCE source not related to current IRP sites. Field evidence and further review of CAFB records suggests that TCE may be attributable to an additional fire training area, located near Building 4126.

The areas of hydrocarbon contamination in groundwater are also revealed by results of the soil gas survey, which identified similar areas with hydrocarbon vapors in the subsurface. The contamination is associated with fuels storage and handling facilities at Site 17. Based on these findings, the IRP sites were grouped as follows:

1. Sites which have no significant impact (NSI) on human health. No further action is necessary unless impacts on wildlife can be substantiated.
2. Sites which have a low or moderate potential for impact on human health. Remedial action is appropriate.
3. Sites which have a high potential impact on human health or which pose an immediate and direct health hazard. Swift remedial action is required.

Considering the results of the field program and the baseline risk assessment, the following sites may be placed into the group indicating no further action is necessary.

Site	Rationale
LF03 (Site 3)	Little evidence of disposal actions, no soil contamination, some metals in groundwater above MCLs, little or no opportunity for exposure.
FDTA 1 (Site 11)	No soil or groundwater contamination, little opportunity for exposure.

LF04 (Site 4) and the Waste Burial Area (Site 10) are shown to have no significant impact in terms of risk assessment. The risk assessment focused on possible exposures due to contaminants, which were judged to be minimal at the sites themselves. However, since both of these sites are underlain by, but not necessarily contributing to, the groundwater TCE plume at the Flightline Area, these sites are considered to be in the second group.

Sites in the second group, indicating a low to moderate health risk, and for which remedial actions are appropriate are listed. The preliminary risk assessment ranking number indicates the relative priority of action, with a rank of 1 indicating the greatest need for action.

Site	Preliminary
FDTA 2 (Site 12)	1
Unnamed Stream (Site 16)	2
BSS (Site BSS)	3*
Entomology Dry Well (Site 15)	3*
LF01 (Site 1)	3*
Flightline Drainage Ditch (Site 13)	3*
Weapons Storage Area (Site WSA)	4
POL Tank Farm (Site 17)	5
LF05 (Site 5)	6

LF04 (Site 4)	7*
Waste Burial Area (Site 10)	7*

* Equivalent ranking, based on magnitude of contaminant concentrations which might reach sensitive receptors.

Based on these conclusions, each site was assigned to one of the following IRP categories:

Category 1--Sites where no further action is required.

Category 2--Site requiring additional IRP effort to:

1. Determine the toxicity, mobility, and volume (TMV) of detected contaminants;
2. Evaluate human health and environmental risks associated with each contaminant; and
3. Conduct the detailed evaluation of remedial alternatives.

Category 3--Sites where the FS process has been completed.

Sites investigated during the Stage 2 program fall into either Category 1 or Category 2. No sites were eligible for inclusion into Category 3, since only the first phase of the FS process was completed and remedial alternatives were not selected.

Category 1 Sites

Results of the Stage 2 investigation indicate that the following two sites had no further action:

1. LF03 (Site 3), and
2. FDTA 1 (Site 11).

Category 2 Sites

Category 2 sites are defined as sites requiring additional monitoring, effort to quantify or further assess the extent of contamination, and/or detailed evaluation of remedial alternatives. The sites or groups of sites listed as Category 2 sites are the following:

1. LF01 (Site 1);
2. LF04, LF05, and Waste Burial Area (Sites 4, 5, and 10);
3. FDTA 2 (Site 12);
4. Flightline Drainage Ditch (Site 13);
5. Entomology Dry Well (Site 15);
6. Unnamed Stream (Site 16);
7. POL Tank Farm (Site 17);
8. BSS (Site BSS); and
9. Weapons Storage Area (Site WSA).

Upon review of the results of the initial Stage 2 investigation, it was determined that further characterization was necessary. During this phase, efforts were concentrated at specific sites within the East Area and Flightline Area where data gaps existed. These investigations were performed during 1990 and the reports of findings were submitted in April 1991.

East Area

The 1990 effort was limited to further characterization of these four East Area sites:

1. LF01
2. Site SD13--Unnamed Stream and Abandoned Gasoline Station
3. Site ST14--POL Tank Farm
4. Site BSS--Base Service Station

Two major tasks were performed to address existing data gaps. Monitor wells were installed at Sites SD13 and ST14 to provide new or additional information on the extent of Upper Zone groundwater contamination, the potentiometric surface configuration, and groundwater flow directions. One additional round of groundwater samples was collected from the newly installed and existing monitor wells, and four surface water samples were collected from Unnamed Stream at

Site SD13. All samples were analyzed for waste-specific indicator chemicals for each site.

The Upper Zone aquifer was the focus of the East Area IRP efforts. No definable VOC or metals contaminant plumes were identified in the Upper Zone groundwater at LF01. Although several VOCs were detected in past sampling efforts and in groundwater samples collected most recently in 1990, all concentrations have been below MCLs. Further, the occurrence of detectable concentrations of VOCs is sporadic, and therefore inconsistent with the existence of a coherent plume. No metals were detected in concentrations above MCLs in any groundwater or surface water samples collected in 1990. Therefore, the previously interpreted metals contamination is not supported by the most recent data.

IRP activities conducted at Site SD13 (Unnamed Stream and Abandoned Gasoline Station) in 1985 revealed high levels of organic compounds in groundwater, probably originating from petroleum hydrocarbons. However, based on the 1990 VOC analytical results, the abandoned gasoline station does not appear to be contributing appreciable organic contamination to the shallow groundwater system. No metals were detected above MCLs in the shallow groundwater at Site SD13. Any groundwater contaminants would be expected to move hydraulically downgradient, eventually entering either the oil/water separator and the Unnamed Stream or Farmers Branch, where the initially low groundwater concentrations would be further diluted. Still more dilution of contaminants would result as Farmers Branch flows into the West Fork of the Trinity River less than 1/2 mile from Site SD13. Any VOCs entering Farmers Branch and the Trinity River would be subject to volatilization to the air.

No VOCs were detected above MCLs in the surface water samples from Site SD13. The results of the laboratory analysis for inorganic constituents suggest that metals in the Unnamed Stream are preferentially adsorbed to

sediments rather than remaining dissolved in the surface water. Total arsenic and total lead were detected above MCLs in at least one surface water sample. Selenium in one sample was the only metal reported above the MCL in any dissolved metals analysis. This concentration was determined to be a reporting error and was actually below the detection limit. As evidenced by the lower dissolved and total concentrations of arsenic and lead in the downstream water samples, the metals apparently tend to accumulate in the stream bed sediments. Iron oxides, observed coating bottom sediments in the Unnamed Stream in the Phase II Stage 1 investigation, suggest that precipitation of metals is active. As long as the source of these metals persists, the metals will continue to accumulate in the sediments in the upper reaches of the stream.

Benzene, ethylbenzene, chlorobenzene, toluene, and total xylenes were detected in the groundwater at Site ST14 (POL Tank Farm). Of these, ethylbenzene was the most common. However, benzene was the only VOC detected at a concentration which exceeded its MCL. Two separate accumulations of benzene are suggested. These plumes are roughly coincident with the two plumes interpreted earlier. Monitor well ST14-17M, located at the center of the benzene plume beneath the fuel loading facility, had the highest concentration of benzene, and the only concentration in excess of the MCL. Over 2 ft of free product was encountered at ST14-17M during the 1990 sampling event. The highest concentrations of chlorobenzene, toluene, and total xylenes were also detected in this well.

Chromium was detected above its MCL in only one well at Site ST14, and this concentration was measured in the total metals analysis. Lead was detected above MCLs in three monitor well samples at ST14, but only one analysis was for dissolved metals. The single dissolved lead occurrence above the MCL does not suggest significant groundwater contamination.

VOCs and metals were detected at the BSS. In the previous Stage 2 investigation (Radian, 1989), VOCs were detected primarily in groundwater samples from monitor well BSS-B. In samples collected during the spring 1990 sampling event, VOCs were detected only in this well. Because of the apparent localized nature of the VOC contamination, the underground storage tank (UST) adjacent to monitor well BSS-B is interpreted as the source of the observed contamination.

In the 1990 sampling event, cadmium was detected above the MCL in monitor well BSS-C in the total metals analysis. Cadmium was not detected in any other well or in the filtered sample (dissolved metal fraction) from the same well. Therefore, groundwater contamination at the site is interpreted to be limited to VOCs.

In general, the contaminant concentrations detected in groundwater and surface water samples collected in 1990 were lower than the concentrations of those same analytes detected in previous IRP studies. This trend may be the result of normal variability or natural attenuation of these constituents in the groundwater and surface water systems. However, the weeks immediately preceding the spring 1990 sampling event were characterized by abnormally high precipitation (and flooding). The resultant increase in infiltration and recharge may have had the effect of diluting contaminants, resulting in lower concentrations of detected constituents. It is recommended that remedial alternatives to be developed in the FS incorporate technologies (i.e., verification sampling, long-term monitoring) to resolve this uncertainty.

Baseline risk assessments incorporating the 1990 analytical results were performed for the East Area sites included in the 1990 effort. Indicator chemicals, contaminant release, transport and fate mechanisms, and potential receptors and exposure pathways specific to each of the East Area sites were identified and evaluated. All of the East Area sites were determined to pose no

significant human health threat, based on evaluation of carcinogenic and noncarcinogenic (chronic) risks. In all cases, noncarcinogenic risks were too low to merit quantification. Environmental (terrestrial wildlife and aquatic organisms) risks were concluded to be minimal.

Using all available information generated in the IRP, the East Area sites were evaluated using the Defense Priority Model (DPM). The East Area sites (and the combined IRP sites in the Flightline Area) received the following scores and ranks:

Rank	Site	Score
1	Unnamed Stream (SD13)	20,760
2	Flightline Area (LF04, LF05, Waste Burial Area, FDTA 2)	19,381
3	LF01	7,036
4	BSS	5,929
5	POL Tank Farm (ST14)	4,584

Based on a more detailed review of available data, Radian assigns a higher priority to the POL Tank Farm and the BSS, respectively, than to LF01.

Specific recommendations regarding the objectives for remedial actions are to:

1. Reduce or eliminate potential receptors to human health and the environment;
2. Reduce or eliminate the potential for future contaminant migration in the groundwater and surface water; and
3. Reduce, eliminate, or immobilize contaminants in residual wastes or near surface soil (Upper Zone deposits).

Flightline Area

The 1990 effort was limited to further characterization of these four IRP sites:

- LF04
- LF05
- Waste Burial Area
- FDTA 2

The findings of the investigation showed that the groundwater contamination appears to be limited to the shallowest water-bearing zone, known as the Upper Zone aquifer. In the Flightline Area, as well as across CAFB and the adjoining area of AFP4, the Upper Zone consists of unconsolidated Quaternary and Recent alluvial deposits (sand, gravel, silt, and clay) that contain groundwater under unconfined conditions. The Upper Zone deposits in the Flightline Area vary from approximately 5 to 49 ft thick and are underlain by low permeability limestones and shales of the Cretaceous Goodland and Walnut Formations which form a basal aquiclude. Groundwater in the Upper Zone was encountered at depths ranging from approximately 4 to 30 feet below ground surface (ft-bgs) and groundwater flow in the Flightline Area is generally toward Farmers Branch. A series of hydrogeologic cross sections through the Flightline Area was prepared from boring logs and synoptic water level measurements.

TCE, vinyl chloride, tetrachloroethene, and the cis- and trans- isomers of 1,2-dichloroethene (12DCE) are the main contaminants detected in the groundwater and surface water in the Flightline Area. Based on the concentrations and distribution of these compounds in groundwater, most recently determined in the 1990 sampling and analysis program, the four former waste disposal areas (LF04, LF05, Waste Burial Area, and FDTA 2) appear to be sources for some of the groundwater contaminants detected downgradient of the sites. However, all of these compounds were also detected in samples from monitor wells located hydraulically upgradient of all CAFB IRP sites in the Flightline Area, indicating that additional offbase sources must also be contributing to the existing Upper Zone groundwater contamination. The occurrence of VOCs in the Upper Zone groundwater on the AFP4 property, upgradient of the Flightline Area, has been documented. The source(s) of the contamination on AFP4 have thus far not been identified. However, it is likely that they are also the source(s) for the contamination detected in the upgradient Flightline Area wells and are contributing some component to the contaminant plumes that exist downgradient of the Flightline Area IRP sites.

In conjunction with lithologic logs obtained in previous drilling efforts, logs from the new soil borings were used to delineate the thick accumulations of sand and gravel deposited in paleochannels eroded into the surface of the underlying bedrock. The areas of thickest sediment correspond well with the highest concentrations of TCE determined in 1988, suggesting that TCE (and other groundwater contaminants) may be preferentially migrating along these relatively permeable deposits in the Upper Zone. The locations of existing CAFB monitor wells and wells installed in the Flightline Area by Hargis & Associates, Inc., for AFP4 were reviewed to determine the optimum locations for the new wells installed in 1990. Locations were selected to assess the preferential pathway hypothesis, as well as to better determine the areal extent of contamination and the degree of continuity of the onsite contaminant plume with documented groundwater contamination present upgradient on the adjacent AFP4 property. The latter objective could not be achieved because no AFP4 wells were sampled concurrently with the CAFB Flightline Area wells.

The monitor wells installed in 1990 were completed to intercept the base of the Upper Zone Aquifer to determine if dense non-aqueous phase liquid (DNAPL) contaminant is present in the Flightline Area. None was detected.

The results of the 1990 sampling and analytical effort confirmed that migration of the VOC contaminant plumes in the Upper Zone groundwater does occur preferentially within the eroded bedrock paleochannels. A secondary component of movement is in the direction of groundwater flow, generally toward Farmers Branch. The maximum downgradient limit of vinyl chloride contamination was defined by the existing well network, which was also adequate to identify multiple sporadic occurrences of tetrachloroethene (PCE). However, the areal extent of TCE and total 12DCE in groundwater was not determined. Samples from monitor wells located along the downgradient limit of the well network contained concentrations from 1,300 to 2,700 μg/L, and 280 to 540 μg/L, respectively.

In contrast to findings and interpretations from previous investigations, the groundwater and surface water analytical results for samples collected in 1990 provide little evidence of a metals contamination problem. No metals were detected in concentrations above MCLs in any samples analyzed for dissolved metals and there is no apparent pattern to the few detected concentrations above MCLs in the total metals analyses. In previous sampling events, only the total metals fractions were analyzed.

A baseline risk assessment, incorporating the 1990 analytical results, was performed for the Flightline Area. FDTA 2 was not included in the risk assessment because a remedial action has been selected for this site. The remedial design includes technologies that eliminate the potential for continuing releases from the site. Indicator chemicals, contaminant release, transport and fate mechanisms, and potential receptors and exposure pathways specific to the Flightline Area were identified and evaluated. The Flightline Area was determined to pose no significant human health threat, based on evaluation of carcinogenic and noncarcinogenic (chronic) risks. Environmental (terrestrial wildlife and aquatic organisms) risks were determined to be minimal.

Using all available information generated in the IRP, the Flightline Area (LF04, LF05, Waste Burial Area, and FDTA 2) was evaluated using the DPM. The Flightline Area received a total score of 19,381 and ranked second among the five CAFB IRP sites/areas evaluated with the model. While the Flightline Area contamination poses no immediate human health threat, remedial action is indicated to prevent continuing contaminant release and migration. It is anticipated that all of the required data can be obtained within the detailed design phase of the selected remedial action, and no additional separate remedial investigation effort is proposed.

1.2.4 RCRA PERMITTING

In response to federal legislation requiring the permitting of all facilities which generate hazardous wastes, a separate investigation was initiated in 1989 as part of the RCRA Facility Assessment (RFA). The purpose of this study is to perform corrective actions on SWMUs and other areas of concern (OACs) at interim status hazardous waste management facilities. These actions were mandated by the 1984 Hazardous and Solid Waste Amendments (HSWA), which delegate authority to EPA. These corrective actions are intended to address unregulated releases of hazardous constituents to air, surface water, soil, and groundwater, as well as the generation of subsurface gas.

The major objective of the RFA program is to identify releases and potential releases and to determine which of these require further investigation or immediate response. According to EPA's RCRA Facility Assessment Guidance Document, the following are the four purposes of an RFA:

1. Identify and gather information of releases at RCRA-regulated facilities;
2. Evaluate SWMUs and OACs for releases to all media, and evaluate regulated units for releases to media other than groundwater;
3. Make preliminary determinations regarding releases of concern and the need for further actions and interim measures at the facility; and
4. Screen from further investigation those SWMUs which do not pose a threat to human health and the environment.

The three basic steps of the RFA consist of a Preliminary Review (PR) of available information, a Visual Site Inspection (VSI) to verify information collected during the PR and to obtain additional information on releases, and, if warranted, a Sampling Visit (SV) to fill data gaps by obtaining field sampling and analytical data. Each of the IRP sites identified in the facility restoration program was visited during the VSI. The PR/VSI was submitted in March 1989,

and the following is a listing of the findings and recommendations determined for each of the SWMU sites investigated during the VSI:

SWMU #	Site Description	Recommendation
1	Pathological Waste Incinerator	No Further Action
2	Pathological Waste Storage Shed	No Further Action
3	Metal Cans	No Further Action
4	Facility Dumpster	No Further Action
5	Building 1628 Waste Accumulation Area	A Remedial Feasibility Investigation (RFI) is warranted due to presence of stressed vegetation and surface staining.
6	Building 1628 Wash Rack and Drain	An RFI is warranted due to questionable integrity of subsurface piping.
7	Building 1628 Oil/Water Separator	No Further Action
8	Building 1628 Sludge Collection Tank	No Further Action
9	Building 1628 Work Station Waste Area	No Further Action
10	Building 1617 Work Station Waste Area	No Further Action
11	Building 1617 Waste Accumulation Area	No Further Action
12	Building 1619 Waste Accumulation Area	An RFI is warranted due to evidence of potential releases.
13	Building 1710 Visual Information Center Work Station Waste Accumulation Areas	No Further Action
14	Building 1060 Bead Blaster Collection Tray	No Further Action
15	Building 1060 Paint Booth Vault	No Further Action
16	Building 1060 Waste Accumulation Area	An RFI is warranted due to evidence for potential releases.
17	Landfill No. 7	An RFI is warranted due to potential for presence of hazardous materials.
18	FTA-1 (IRP #11)	An RFI is warranted due to the documented presence of groundwater and soil impacts.

19	FTA-2 (IRP #12)	An RFI is warranted due to the documented presence of groundwater and soil impacts.
20	Waste Fuel Storage Tank	An RFI is warranted due to the documented presence of groundwater and soil impacts.
21	Waste Oil Tank	An RFI is warranted due to the potential for subsurface releases.
22	LF04 (IRP #4)	An RFI is warranted due to the documented presence of groundwater and soil impacts.
23	LF05 (IRP #5)	An RFI is warranted due to the documented presence of groundwater and soil impacts.
24	Waste Burial Area (IRP #10)	An RFI is warranted due to the documented presence of groundwater and soil impacts.

For each of those SWMU sites where an investigation was warranted, work plans were submitted in 1992 for review. The field investigations were initiated soon thereafter, and, to date, only one has been completed. This site is SWMU No. 62 (LF06). The report of the investigation was submitted in June 1993.

1.2.5 MISCELLANEOUS ASSESSMENT INVESTIGATIONS

Several miscellaneous assessment projects have been conducted at CAFB which were performed outside of the realm of the IRP. A review of these projects is as follows:

1. Jet Fuel Assessment--Fuel Hydrant System. The purpose of the investigation was to delineate the degree of jet fuel contamination present in the soil at buried fuel tanks located at the Hydrant Fueling Facility. The investigation involved the collection of soil samples around five pumphouses (Pumphouse Nos. 4150, 4152, 4153, 4154, and 4170). Contamination was discovered at several of the pumphouses. The source of the soil contamination is thought to be leakage from buried fuel tanks, lines, or connections at the pumphouse facility.

2. Pesticide Assessment--White House Communication Building 1337. The purpose of the investigation was to determine the impact to the environmental media near Building 1337 (White House Communications). Pesticide impacts were detected in the soil during previous sampling investigations conducted near the site. The scope of work for this investigation called for the advancement of borings to collect soil samples for determination of any pesticide impacts. The results of the investigation indicated that samples contained very low concentrations of pesticides, PCBs, endrin aldehyde, and traces of hydrocarbon constituents.
3. Radium Assessment--Weapons Storage Area. Groundwater samples were collected from the operational water well in Building 8504 for testing gross alpha activity and chemically tested for radium 226 and 228. Test results from 8 of the 19 samplings showed concentrations above the limit of 5 picocuries per liter (pCi/L) for State of Texas drinking water standards. However, none of the gross alpha values exceeded the 15 pCi/L State of Texas drinking water standards. Tests of three of the eight samplings produced values at least twice the maximum allowed, while the other five had test values only slightly above the maximum value permitted. Test values of gross alpha activity varied widely but presented no recognizable pattern, appearing almost randomly. Additional work was recommended.
4. Spot 35. No information is available regarding the specifics of this investigation.
5. Waste Oil Dump. No information is available regarding the specifics of this investigation.

1.2.6 MISCELLANEOUS DOCUMENTS

Several miscellaneous studies have been completed which were performed in association with the IRP. The following is a review of these projects:

1. Community Relations Plan (CRP). The CRP is part of the program implemented at all installations with IRP sites, in accordance with DOD and EPA guidelines. This proactive public information program is required by CERCLA to help ensure that the community will: (1) be informed of planned and ongoing activities, (2) be given the opportunity to comment on and provide input to technical decisions, and (3) environmental concerns are addressed as early as possible during the remedial process. The CRP addresses activities to inform the public, such as preparation and coordination of news releases, development of fact sheets for general distribution, community interviews, and information repositories.

2. Environmental Impact Statement (EIS). In response to the planned closure of CAFB in September 1993, USAF was required to comply with the National Environmental Policy Act (NEPA) in the implementation of the base disposal and reuse. USAF must now make a series of interrelated decisions concerning the disposition of base property. This EIS has been prepared to provide information on the potential environmental impacts resulting from disposal and proposed reuse of the base property. The Federal Aviation Administration (FAA) and the Federal Bureau of Prisons (FBOP) are cooperating agencies in the preparation of this EIS, who will make decisions on their own and assist USAF in making related decisions concerning CAFB property. Several alternative reuse concepts are studied to identify the range of potential direct and indirect environmental consequences of disposal. After completion and consideration of this EIS, USAF will prepare decision documents stating what property is excess and surplus, and the terms and conditions under which the dispositions will be made. These decisions may affect the environment by influencing the nature of the future use of the property.

1.3 TASK 1 REPORT

This draft report specifically addresses Task 1, Summary of Hydrologic and Chemical Characterization Studies For the Study Area. Task 1 requires that ESE develop and provide a comprehensive report documenting hydrologic conditions and chemical contaminants within the study area, which consists of CAFB and AFP4.

Section 1.4 of this report presents a discussion detailing the records review effort associated with preparing this report and specifically address the following:

1. Items to be presented in this report (in accordance with the project scope of work),
2. Site visits conducted to support the records review task, and
3. The specific reports reviewed and evaluated.

Section 2.0 presents a summary of the geohydrology of the site, including geologic formations, aquifer systems, and groundwater flow characteristics.

Section 3.0 presents an overview of site assessment projects conducted to date. Appendices A and B present summaries of individual reports, which were prepared for each of the assessment projects described in Section 3.0.

1.4 RECORDS REVIEW

The scope of work (SOW) for Task 1 specifies a review be performed of all available pertinent information concerning projects that were/are commissioned to assess environmental contamination resulting from activities at CAFB and/or AFP4. To accomplish the objectives for Task 1, two ESE professionals (one geologist and one engineer) visited several locations to collect information pertinent to preparing the specified report.

The following are the locations and times of the site visits:

1. Wright-Patterson Air Force Base (WPAFB), October 12 through October 14, 1993, to collect information pertinent to AFP4;
2. Federal Building, Ft. Worth, Texas, October 19 and 20, 1993, to collect information pertinent to CAFB;
3. CAFB, Ft. Worth, Texas, October 20, 1993, to collect information pertinent to CAFB.

Table 1.4-1 lists all reports that were reviewed as part of the records review conducted for Task 1.

The SOW specifies that the following information elements be detailed in this Task 1 report:

1. Assessment project objectives,
2. Project accomplishments/results,
3. Data/information developed as a result of the project,
4. Recommendations for additional studies,
5. Project status,
6. Schedule (if ongoing),
7. Whether or not information derived is in the IRPIMS, and
8. Discrepancies between various project reports and recommendations as to the most reasonable resolution of the discrepancies.

Table 1.4-2 lists those reports that were considered to present information relevant to the project goals. Information from these reports are summarized in Section 3.0 and are detailed in Appendices A and B.

Table 1.4-1. Reports Reviewed as Part of the Records Review

Document Number	Title	Author	Date
CAFB-1	Installation Restoration Program Stage 2 Volume 1: Technical Report	Radian Corporation	October 1988
CAFB-9	Installation Restoration Program Stage 2 Volume 2: Appendix A-E	Radian Corporation	October 1988
CAFB-83	Installation Restoration Program Phase II- Confirmation/Quantification Stage 1 Volume 1: Final Report	Radian Corporation	October 1986
CAFB-85	Installation Restoration Program Phase II- Confirmation/Quantification Stage 1 Volume 3 - Appendices B-L	Radian Corporation	
CAFB-66	Installation Restoration Program Stage 1 Draft Report Weapons Storage Area Site WSA-1	Radian Corporation	
CAFB-2	Integrated IRP Phase II- Confirmation/Quantification Stage 2-Draft Work Plan	Radian Corporation	
CAFB-65	Installation Restoration Program Stage 2 Site Characterization Report for Flightline Area	Radian Corporation	
CAFB-97	Stage 2 Draft Remedial Investigation Report for Flightline Area	Radian Corporation	May 1991
CAFB-99	Installation Restoration Program Stage 2 Draft Report Remedial Investigation Report for Flightline Area, Appendix H	Radian Corporation	May 1991
CAFB-73	Installation Restoration Program Stage 2 Final Report Remedial Investigation Report for East Area	Radian Corporation	October 1991

Table 1.4-1. Reports Reviewed as Part of the Records Review (Continued, Page 2 of 6)

Document Number	Title	Author	Date
CAFB-74	Installation Restoration Program Stage 2 Final Report Remedial Investigation Report for Flightline Area	Radian Corporation	October 1991
CAFB-3	Installation Restoration Program Stage 2 Final Report Remedial Investigation Report for Flightline Area	Radian Corporation	October 1988
CAFB-12	Environmental Compliance Assessment and Management Program Draft Final Environmental Evaluation Report	Science and Engineering Associates, Inc.	April 1990
CAFB-14	Preliminary Report Environmental Compliance Assessment and Management	Argonne National Laboratories	June 1-5, 1992
CAFB-15	Samples Results	Compiled by Carswell	1992 and prior
CAFB-16	Samples Results from Spills	Compiled by Carswell	1992 and prior
CAFB-17	Final RCRA Part B Permit Application DRMO-Carswell I thru VIII and Appendices A-K	Hazardous Materials Technical Center	August 14, 1987
CAFB-67	RCRA Permit, Part B #HW50289 Work Plan SWMU No. 62, Landfill No. 6	U.S. Army Corps of Engineers Fort Worth District	April 7, 1992
CAFB-68	RCRA Permit, Part B #HW50289 Investigation/Remediation Plans SWMU No. 16, SWMU No. 32, SWMU No. 35, SWMU No. 36, SWMU No. 61	U.S. Army Corps of Engineers Fort Worth District	January 31, 1991
CAFB-69	RCRA Permit, Part B #HW 50289 Preliminary Remedial Action Plans SWMU No. 16, SMWU No. 22, SWMU No. 23, SWMU No. 24, SWMU No. 32, SWMU No. 36, SWMU No. 36, SWMU No. 61, SWMU No. 68	U.S. Army Corps of Engineers Fort Worth District	September 9, 1991

Table 1.4-1. Reports Reviewed as Part of the Records Review (Continued, Page 3 of 6)

Document Number	Title	Author	Date
CAFB-70	RCRA Permit, Part B #HW 50289 Work Plan SWMU No. 62, Landfill No. 6		October 7, 1991
CAFB-71	RCRA Permit, Part B #HW 50289 Work Plan SWMU No. 64 Building 1340-Oil Water Separator		October 7, 1991
CAFB-77	RCRA Permit, Part B #HW 50289 Request for Dismissal SWMU No. 18, Fire Dept. Training Area #1. SWMU No. 63, Entomology Dry Well		July 25, 1991
CAFB-78	RCRA Permit, Part B #HW 50289 Investigation/Remediation Report Removal of Buried Drums and an Underground Storage Tank SWMU No. 24, West Burial Area		January 31, 1991
CAFB-79	RCRA Permit, Part B #HW 50289 RCRA Facility Investigation/Remediation Plan Removal of Buried Drums and an Underground Storage Tank SWMU No. 24, West Burial Area		May 7, 1991
CAFB-81	RCRA Permit, Part B #HW 50289 Volume 3 RFI Work Plans East Area Remedial Investigations Weapons Storage Area Other (Non-IRP) Site Investigations	Radian Corporation	May 7, 1991
CAFB-82	RCRA Permit, Part B #HW 50289 Volume 2 RFI Work Plans Flightline Area Site Characterization Flightline Area Feasibility Study	Radian Corporation	May 7, 1991

Table 1.4-1. Reports Reviewed as Part of the Records Review (Continued, Page 4 of 6)

Document Number	Title	Author	Date
CAFB-20	Installation Restoration Program Final Report Weapons Storage Area, Site WSA-1 USAF Contract No. F33615-84-D-4402 Order No. 0006/02	Radian Corporation	May 1989
CAFB-21	Installation Restoration Program RI/FS Study Draft Decision Paper	Radian Corporation	October 5, 1989
CAFB-52	Comprehensive Plan Final Submittal Contract F4613-84-C005	Pierce Godwin Alexander	May 1986
CAFB-80	Subsurface Contamination Assessment White House Communications	Maxim Engineers, Inc.	April 18, 1990
CAFB-86	Installation Restoration Program records Search Contract No. F08637-80-G0010-5009	CH2M Hill	February 1984
CAFB-87	RCRA Facility Assessment PR VSI Report EPA ID Number TXD571924042	A.T. Kearny, Inc.	March 1989
CAFB-95	POL Tank Farm 9 pt. Letter	--	
CAFB-96	Decision Documents and No Further Action	Radian Corporation	
CAFB-X01	AFP-4 Window Area Lab Analysis	--	February 1993
CAFB-X02	Sampling Results, ST16 BSS	U.S. Army Corps of Engineers	May 1993
CAFB-X03	Investigation of Groundwater Pollution at AFP4	U.S. Army Corps of Engineers	October 1986
CAFB-X04	Preliminary Assessment Radium-WSA	U.S. Army Corps of Engineers	January 1992
CAFB-X05	Community Relations Plan	U.S. Army Corps of Engineers	April 1993
CAFB-X06	Spot 35 Contamination Assessment	U.S. Army Corps of Engineers	November 1992
CAFB-X07	Soil Gas Survey ST-16	Target	March 1993
CAFB-X08	Draft EIS	--	February 1993
CAFB-X09	Contamination Assessment Waste Oil Dump (DP-17)	U.S. Army Corps of Engineers	May 1993

Table 1.4-1. Reports Reviewed as Part of the Records Review (Continued, Page 5 of 6)

Document Number	Title	Author	Date
CAFB-X10	Contamination Assessment Landfill 6, SWMU 62	U.S. Army Corps of Engineers	June 1993
CAFB-X11	Removal of Buried Drums UST SWMU No. 24	U.S. Army Corps of Engineers	January 1992
CAFB-X12	Summary of Chemical Analysis Volume II Waste Oil Dump	U.S. Army Corps of Engineers	
CAFB-X13	Summary of Chemical Analysis Landfill 6	U.S. Army Corps of Engineers	
CAFB-X14	RI/FS Safety Plan (ST-16)	U.S. Army Corps of Engineers	April 1993
CAFB-X15	Summary of Clinical Analysis Volume I Waste Oil Dump	U.S. Army Corps of Engineers	
CAFB-X16	Groundwater Remediation LF 4 & 5/QA Plan Addendum	IT	April 1993
CAFB-X17	Groundwater Remediation LF 4 & 5/QA Plan Addendum	IT	April 1993
CAFB-X18	Work Plan Consolidated/Disposal Drilling Waste LF 4 & 5 and Window	IT	July 1993
CAFB-X19	Field Sampling Plan Groundwater Remediation Windows Area - AFP4	IT	October 1992
CAFB-X20	Health and Safety Plan Groundwater Remediation AFP4 Window	IT	October 1992
CAFB-X21	Sampling Plan Groundwater Remediation AFP4 Window	IT	March 1993
CAFB-X22	QA Plan Groundwater Remediation LF 4 and 5 AFP4 & CAFB	IT	March 1993
CAFB-X23	HASP Preliminary Assessment Site Investigation and RI/FS, AFP4	Geotech	August 1990
CAFB-X24	QA Plan Preliminary Assessment Site Investigation and RI/FS, AFP4	Geotech	August 1990

Table 1.4-1. Reports Reviewed as Part of the Records Review (Continued, Page 6 of 6)

Document Number	Title	Author	Date
CAFB-X25	Analytical Results Recovery Well CAR-RW2	U.S. Army Corps of Engineers	June 1993
CAFB-X26	HASP Subsurface Barrier wall Landfill No. 3, AFP4	IT	March 1993
CAFB-X27	Sampling Plan Subsurface Barrier Wall Landfill No. 3, AFP4	IT	March 1993
CAFB-X28	QA Plan Subsurface Barrier Wall Landfill No. 3, AFP4	IT	March 1993
CAFB-X29	Summary of Well Maintenance Activity AFP4	Hargis	May 1993
CAFB-X30	IRP Quantity Report AFP4	HLS	April 1992
CAFB-X31	Phase I and II Field Sampling & Analysis LF 4 & 5	IT	August 1993
CAFB-X32	RCRA Permit RFI Work Plans Volume 1 HASP QAP	--	May 1991
CAFB-X33	IRP Quantity Report AFP4	--	June 1992
CAFB-X34	RI/FS Work Plan Site 16 BSS	--	March 1993
CAFB-X35	IRP Record Search	CH2M Hill	February 1984
CAFB-X36	Phase II Report Groundwater Sampling and Soil	Geo	October 1993

Source: ESE.

Table 1.4-2. Reports Presenting Information Relevant to Project Goals

Document Number	Title	Author	Date
AFP4-01001	Phase I Investigation, Drilling and Construction of Upper Zone Test Holes and Monitor Wells	Hargis & Montgomery	01/31/83
AFP4-01002	Installation Phase I Investigation of Subsurface Conditions at U.S. Air Force Plant 4, Fort Worth, Texas, Volume 1 (Text)	Hargis & Montgomery	02/03/83
AFP4-01003	Installation Phase I Investigation of Subsurface Conditions at U.S. Air Force Plant 4, Fort Worth, Texas, Volume II, (Illustrations)	Hargis & Montgomery	03/03/83
AFP4-01004	Installation Phase I Investigation of Subsurface Conditions at U.S. Air Force Plant 4, Fort Worth, Texas, Volume III (Appendices)	Hargis & Montgomery	03/03/83
AFP4-01005	Construction of Paluxy Monitor Well P-1, U.S. Air Force Plant 4, Fort Worth, Texas	Hargis & Montgomery	03/18/83
AFP4-01008	Environmental, Energy, and Resource Conservation Review of Air Force Plant 4	JRB Associates	09/03/83
AFP4-01009	Seismic Refraction Survey, Letter Report, General Dynamics, Ft. Worth Division, Project No. 840002	D'Appolonia Waste Management Services	12/31/83
AFP4-01010	Copy of Field Engineer's Notes for Die Yard and Chrome Pits Excavation Project and Analytical Lab Results	General Dynamics	01/31/84
AFP4-01011	Installation/Restoration Program Records Search for Air Force Plant 4, Texas	CH_2M Hill	08/31/84
AFP4-01012	Conclusion and Recommendations for Completion of Phase II Investigation	Hargis & Associates	10/25/84
AFP4-01013	Phase II Investigation of Subsurface Conditions Vol. I	Hargis & Associates	09/30/85
AFP4-01014	Phase II Investigation of Subsurface Conditions, Volume II, Appendices A-E	Hargis & Associates	09/30/85

Table 1.4-2. Reports Presenting Information Relevant to Project Goals (Continued, Page 2 of 7)

Document Number	Title	Author	Date
AFP4-01015	Phase II Investigation of Subsurface Conditions, Volume III, Appendices F-G	Hargis & Associates	09/30/85
AFP4-01016	Phase II Investigation of Subsurface Conditions, Volume IV, Appendices H-I	Hargis & Associates	09/30/85
AFP4-01017	Phase II Investigation of Subsurface Conditions, Volume V, Appendices J-M	Hargis & Associates	09/30/85
AFP4-01018	Draft Installation Restoration Program, Phase II, Confirmation/Qualification, Stage 1, Volume 1, Final Draft Report for Carswell AFB	Radian Corporation	09/30/85
AFP4-01019	Installation Restoration Program, Phase II, Confirmation/Qualification, Stage 1, Volume 2 - Appendix A, Draft Final Report for Carswell AFB	Radian Corporation	09/30/85
AFP4-01020	Installation Restoration Program, Phase II, Confirmation/Qualification, Stage 1, Volume 3 - Appendices B-L, Draft Final Report for Carswell AFB	Radian Corporation	09/30/85
AFP4-01022	Results of Soil and Groundwater Assessment for the Proposed Systems Development Laboratory and Anechoic Chamber Buildings	Hargis & Associates	12/16/85
AFP4-01023	Proposed 1986 Hydrologic Monitoring Plan, U.S. Air Force Plant No. 4, Ft. Worth, Texas	Hargis & Associates	01/02/86
AFP4-01025	Draft Remedial Action Plan and Conceptual Documents for Fuel Saturation Areas No. 1 and No. 3	Intellus Corporation	07/16/86
AFP4-01026	Interim Report for Ten-Site Field Investigation, Prepared for Air Force Plant 4, Fort Worth, Texas	Intellus Corporation	11/30/86
AFP4-01028	Summary Report Window Area Investigation	Hargis & Associates	04/21/87

Table 1.4-2. Reports Presenting Information Relevant to Project Goals (Continued, Page 3 of 7)

Document Number	Title	Author	Date
AFP4-01029	Assessment Report for Landfill No. 3, Prepared for U.S. Air Force Plant No. 4, Fort Worth, Texas	Intellus Corporation	08/31/87
AFP4-01031	Proposed 1988 Hydrologic Monitoring Plan	Hargis & Associates	12/02/87
AFP4-01032	Installation Restoration Program, Phase II, Confirmation/Quantification, Stage 1, Volume 2 - Appendix A-1, Final Report for September 1985 through September 1986	Radian Corporation	12/31/87
AFP4-01033	Installation Restoration Program, Phase II, Confirmation/Quantification, Stage 1, Volume 3, Appendix A-1, Final Report for September 1985 through September 1986	Radian Corporation	12/31/87
AFP4-01034	Installation Restoration Program, Phase II, Confirmation/Quantification, Stage 1, Volume 4 - Appendix A-1 (continued), Final Report for September 1985 through September 1986	Radian Corporation	12/31/87
AFP4-01035	Installation Restoration Program, Phase II, Confirmation/Quantification, Stage 1, Volume 5 - Appendix A-2, Final Report for September 1985 through 1986	Radian Corporation	12/31/87
AFP4-01036	Installation Restoration Program, Phase II, Confirmation/Quantification, Stage 1, Volume 6 - Appendix A-2 (continued), Final Report for September 1985 through September 1986	Radian Corporation	12/31/87
AFP4-01037	Installation Restoration Program, Phase II, Confirmation/Quantification, Stage 1, Volume 7 - Appendices A-3 and A-4, Final Report for September 1985 through September 1986	Radian Corporation	12/31/87

Table 1.4-2. Reports Presenting Information Relevant to Project Goals (Continued, Page 4 of 7)

Document Number	Title	Author	Date
AFP4-01038	Installation Restoration Program, Phase II, Confirmation/Quantification, Stage 1, Volume 8 - Appendices B-E, Final Report for September 1985 through September 1986	Radian Corporation	12/31/87
AFP4-01039	Installation Restoration Program, Phase II Confirmation/Quantification, Stage 1, Volume 9 - Appendices F-K, Final Report for September 1985 through September 1986	Radian Corporation	12/31/87
AFP4-01040	Installation Restoration Program, Phase II, Final Report - Volume 10, Appendix L, Final Report for September 1985 through September 1986	Radian Corporation	12/31/87
AFP4-01041	Installation Restoration Program, Phase II, Confirmation/Quantification, Stage 1, Volume 1, Report Text, Final Report for September 1985 through September 1986	Radian Corporation	12/31/87
AFP4-01042	Installation Restoration Program, Phase II, Confirmation/Quantification, Stage 2, Carswell Air Force Base Quality Assurance Project Plan	Radian Corporation	01/31/88
AFP4-01045	Underground Storage Tank Program Evaluation, Analysis of USTs at AFP No. 4, Ft. Worth, Texas, Volume III, Appendix F	Hargis & Associates	06/02/89
AFP4-01046	Industrial Hygiene Assessment of Organic Solvents at General Dynamics Plant, Fort Worth, Texas	Clayton Environmental Consultants, Ltd. for Hargis & Associates	08/28/89
AFP4-01047	Environmental Assessment, Advanced Materials Development Laboratory Site	Hargis & Associates	10/20/89
AFP4-01048	Preliminary Assessment/Site Inspection and Remedial Investigation/Feasibility Studies, Final Quality Assurance Project Plan, Air Force Plant 4, Volume III	U.S. Department of Energy	08/31/90

Table 1.4-2. Reports Presenting Information Relevant to Project Goals (Continued, Page 5 of 7)

Document Number	Title	Author	Date
AFP4-01049	Preliminary Assessment/Site Inspection and Remedial Investigations/Feasibility Studies, Final Health and Safety Plan, Air Force Plant 4, Volume IV	U.S. Department of Energy	08/31/90
AFP4-01054	Preliminary Water Quality Monitoring Plan	U.S. Department of Energy	10/31/90
AFP4-01055	Installation Restoration Program, Stage 2, Site Characterization Report for the Flightline Area, Carswell Air Force Base	Radian Corporation	11/30/90
AFP4-01057	Draft Final Groundwater Quality Monitoring Report, January 1992, GJPO-WMP-68, prepared for Headquarters Department of the Air Force, Aeronautical Systems Division, Wright-Patterson AFB, Ohio, Volumes 1 through 5	Chem-Nuclear Geotech, Inc.	01/31/92
AFP4-03001	Water Quality Data, May 1985 to May 1986	Hargis & Associates	08/15/86
AFP4-03002	Water Quality Data, May 1986 to May 1987, Volume 1, Appendices A through C	Hargis & Associates	08/05/87
AFP4-03003	Water Quality Data, May 1986 to May 1987, Volume II, Appendices D through G	Hargis & Associates	08/31/87
AFP4-03004	Final Draft Work Plan, Remedial Investigation and Feasibility Study, Volume I (Text)	Hargis & Associates	01/31/89
AFP4-03005	Final Draft Work Plan, Remedial Investigation and Feasibility Study, Volume II, Appendices C through I	Hargis & Associates	01/31/89
AFP4-03006	Final Draft Work Plan, Remedial Investigation and Feasibility Study, Volume III (Figures)	Hargis & Associates	01/31/89
AFP4-03007	Water Quality Data, May 1987 to January 1989, Volume I, Appendix A	Hargis & Associates	04/20/89
AFP4-03008	Water Quality Data, May 1987 to January 1989, Volume II, Appendices B through G	Hargis & Associates	04/20/89

Table 1.4-2. Reports Presenting Information Relevant to Project Goals (Continued, Page 6 of 7)

Document Number	Title	Author	Date
AFP4-03009	Draft Annual Hydrologic Monitoring Plan	Hargis & Associates	07/19/89
AFP4-03010	Summary of Interim Remedial Investigations, January 1987 to April 1989, Volume I, Text, Tables and Illustrations	Hargis & Associates	07/19/89
AFP4-03011	Summary of Interim Remedial Investigations, January 1987 to April 1989, Volume III, Appendices A through F	Hargis & Associates	07/19/89
AFP4-03012	Summary of Interim Remedial Investigations, January 1987 to April 1989, Volume II, Appendices G through L	Hargis & Associates	07/19/89
AFP4-03013	Annual Hydrologic Monitoring Plan	Hargis & Associates	01/31/89
AFP4-03014	Water Sampling Manual, Preliminary Draft	Hargis & Associates	07/27/89
AFP4-03015	Collection and Analysis of Soil Samples	Versar, Inc.	01/24/90
AFP4-03018	Preliminary Assessment/Site Inspection and Remedial Investigations/Feasibility Studies, Final Sampling and Analysis Plan, Air Force Plant 4, Volume II	U.S. Department of Energy	08/31/90
AFP4-03019	Preliminary Assessment/Site Inspection and Remedial Investigation/Feasibility Studies, Final Work Plan, Air Force Plant 4, Volume I	U.S. Department of Energy	08/31/90
AFP4-03020	Coordination of Installation Restoration Program (IRP) Efforts for Carswell AFB and AFP4 (RE: Letter 14 Mar 84)	AFSC	04/24/84
AFP4-07001	Investigation of Disposal/Cleanup Activities, Waste Disposal Project - West Parking Lot, USAF Plant 4, General Dynamics, Fort Worth Division, Fort Worth, Texas	U.S. Environmental Protection Agency Office of Enforcement and Compliance Monitoring	12/31/83
AFP4-11001	Texas State Board of Water Engineers, Groundwater Resources of Fort Worth and Vicinity, Texas	W.O. George and N.A. rose - Prepared in cooperation with the U.S.G.S.	09/30/42

Table 1.4-2. Reports Presenting Information Relevant to Project Goals (Continued, Page 7 of 7)

Document Number	Title	Author	Date
AFP4-11005	Variations in Specific Yield in the Outcrop of the Carrizo Sand in South Texas as Estimated by Seismic Refraction	Texas Department of Water Resources	04/30/79
AFP4-x01	Results of Chemical Analysis of Liquid Samples - Various Sites	Corps of Engineers	01/93
AFP4-x02	Quality Groundwater Monitoring Report	Handlaw	06/92
AFP4-x04	Phase II Report - Sampling, Analysis, and Testing - Window Area	IT	08/93
AFP4-x05	Final Construction Quality Control Plan	IT	03/93
AFP4-x06	Sampling and Analysis Plan Subsurface Banner Wall Installation Landfill No. 3	IT	03/93
AFP4-x07	Draft Final Preliminary Assessment/Site Inspection & RI Report AFP4	Chem-Nuclear Geotech, Inc.	12/92

Source: ESE.

2.0 STUDY AREA CHARACTERISTICS

2.1 LOCATION

CAFB and AFP4 are located in Tarrant County, Texas, approximately 6 miles west of downtown Fort Worth (Figure 2.1-1). The properties are bordered by Lake Worth to the north, the West Fork of the Trinity River and the community of Westworth to the east and southeast, and the community of White Settlement to the south and southwest. The location of the study area is shown in Figure 2.1-1. One offbase facility, the Weapons Storage Area, has also been the target for environmental investigations. This facility is located approximately 4 miles west of CAFB on White Settlement Road.

2.2 ENVIRONMENTAL SETTING

The following discussion of the environmental setting in the CAFB/AFP4 area is derived primarily from information provided in two major reports of previous investigations--the Installation Restoration Program Phase I Records Search Report (CH2M Hill, 1984) and the Phase II Investigation Report (Radian, 1986).

2.2.1 CURRENT LAND USE

The study area and the adjacent land around the facilities are dedicated primarily to either industrial, residential, or recreational purposes. AFP4 is the principal industrial presence in the area, where aircraft are produced under government contract. The most significant residential area adjacent to the study area is the White Settlement area. Recreational land use includes various parks situated along the shores of Lake Worth.

2.2.2 CLIMATE

The climate in the Fort Worth area is classified as humid subtropical and is typified by hot summers and dry winters. Tropical maritime air masses control the weather during much of the year, but the passage of polar cold fronts and continental air masses can create large variations in winter temperatures. The

FIG211

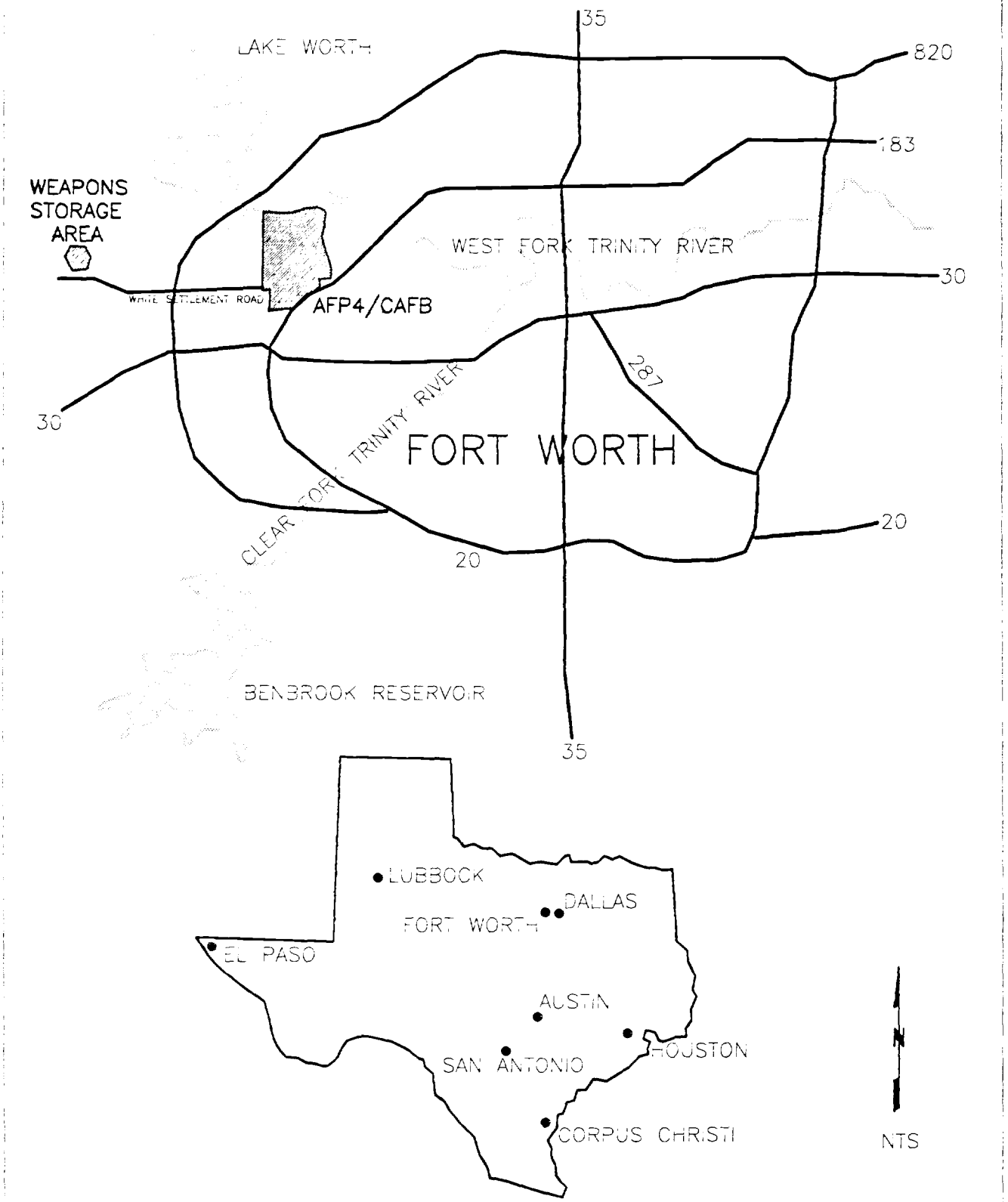

Figure 2.1-1
LOCATION MAP OF AFP4 & CAFB

SOURCE: ESE, CN GEOTEC-

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average annual temperature in the area is 66 degrees Fahrenheit (°F) and monthly mean temperatures vary from 45°F in January to 86°F in July. The average daily minimum temperature in January is 35°F, and the lowest recorded temperature is 2°F. The average daily maximum temperature in July and August is 95°F, and the highest temperature recorded at the base was 111°F in the month of June. On the average, freezing temperatures occur at CAFB on 33 days per year.

Mean annual precipitation recorded at the study area is approximately 32 inches. The wettest month is May, with a secondary maximum in September. The period from November to March is generally dry, with a secondary minimum in August. Snowfall accounts for a small percentage of the total precipitation between November and March. Thunderstorm activity occurs at the study area an average of 45 days per year. The greatest number of these storms occurs between April and June. The maximum precipitation recorded in a 24-hour period is 5.9 inches. Wind direction is predominantly from the south-southwest during all months.

2.2.3 PHYSIOGRAPHY

The study area is located along the border zone between two physiographic provinces. The southeastern part of the study area is situated within the Grand Prairie section of the Central Lowlands Physiographic Province. This area is characterized by broad, eastward-sloping terrace surfaces that are interrupted by westward-facing escarpments. The land surface is typically grass covered and treeless except for isolated stands of upland timber. The northwestern part of the study area is situated within the Western Cross Timbers Physiographic Province. This area is characterized by rolling topography and a heavy growth of post and blackjack oaks.

The land surface in the area is generally flat except for the lower-lying areas along the tributaries of the Trinity River. The land surface slopes gently

northeastward toward Lake Worth, and eastward, toward the West Fork of the Trinity River. Surface elevations on the subject properties range from approximately 690 feet above mean sea level (ft-msl), at the southwest corner of the base, to approximately 550 ft-msl, along the east side of the base.

2.2.4 SOILS

The United States Soil Conservation Service (SCS) has identified four major soil associations in the area of the study area. The surficial soils of the study area include the nearly level to gently sloping clayey soils of the Sanger-Purves-Slidell and the Aledo-Bolar-Sanger Associations. The clayey soil of the Frio-Trinity Association and the loamy soil of the Bastsil-Silawa Association are found along the floodplain and stream terraces of the West Fork of the Trinity River. The characteristics of each soil group is summarized in Table 2.2-1 and the areal limits of their areal distribution are shown on Figure 2.2-1.

2.2.5 GEOLOGIC SETTING

The important geologic units in the area, from youngest to oldest, are as follows: (1) Quaternary Alluvium (including fill material and terrace deposits), (2) Cretaceous Goodland Limestone, (3) Cretaceous Walnut Formation, (4) Cretaceous Paluxy Formation, (5) Cretaceous Glen Rose Formation, and (6) Cretaceous Twin Mountains Formation. An idealized geologic section showing these rock formations is presented in Figure 2.2-2. The areal limits of the surface exposure of these units within the area are shown on Figure 2.2-3.

The soil boring and monitor well drilling program conducted in the study area has provided site-specific data about the upper geologic units st the site. These units include unconsolidated deposits (assorted fill material and alluvium, terrace deposits) and consolidated units (Goodland Limestone, Walnut Formation, and the Paluxy Formation). Each of these units was encountered during portions of the drilling programs.

Table 2.2-1. Soil Associations

Association	Description	Thickness (Inches)	Permeability (cm/sec)
Sanger-Purves-Slidell: Clayey soils of nearly level to gently sloping uplands	Clay loam Clay over bedrock Silty clay	8 to 80	$<4.2 \times 10^{-5}$ to 3×10^{-4}
Aledo-Bolar-Sanger: Loamy and clayey soils of gently sloping to moderately steep uplands	Clay loam over bedrock Clay loam	8 to 70	$<4.2 \times 10^{-5}$ to 9×10^{-4}
Frio-Trinity: Clayey soil on nearly level flood plains	Silty clay loam Clay	25 to 75	$<4.2 \times 10^{-5}$ to 3×10^{-4}
Bastsil-Silawa: Loamy soils on nearly level to sloping stream terraces	Sandy clay loam	40 to 80	9×10^{-4} to 3×10^{-3}

Source: U.S. Department of Agriculture (USDA), 1981.

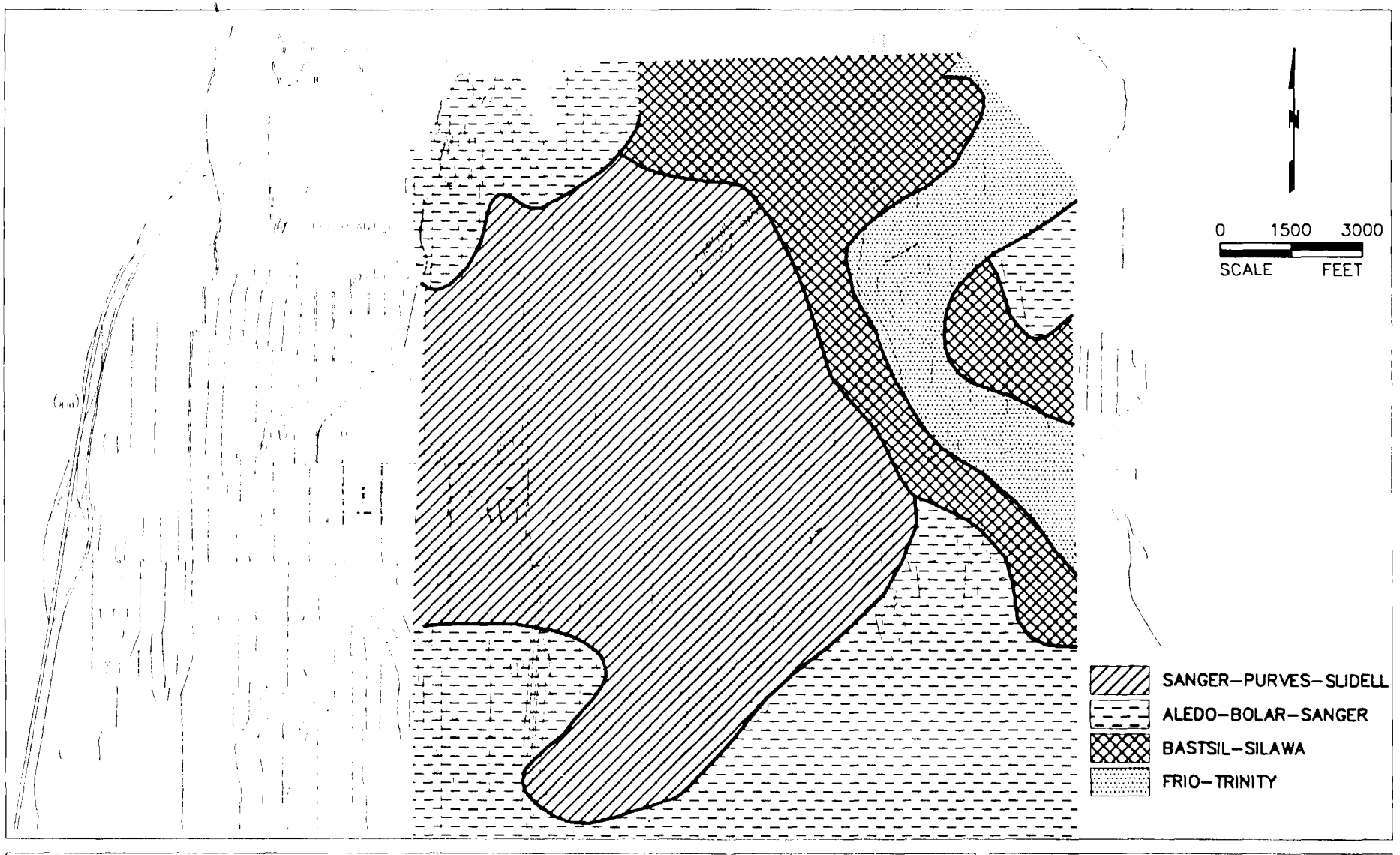

Figure 2.2–1
SOILS ASSOCIATION MAP

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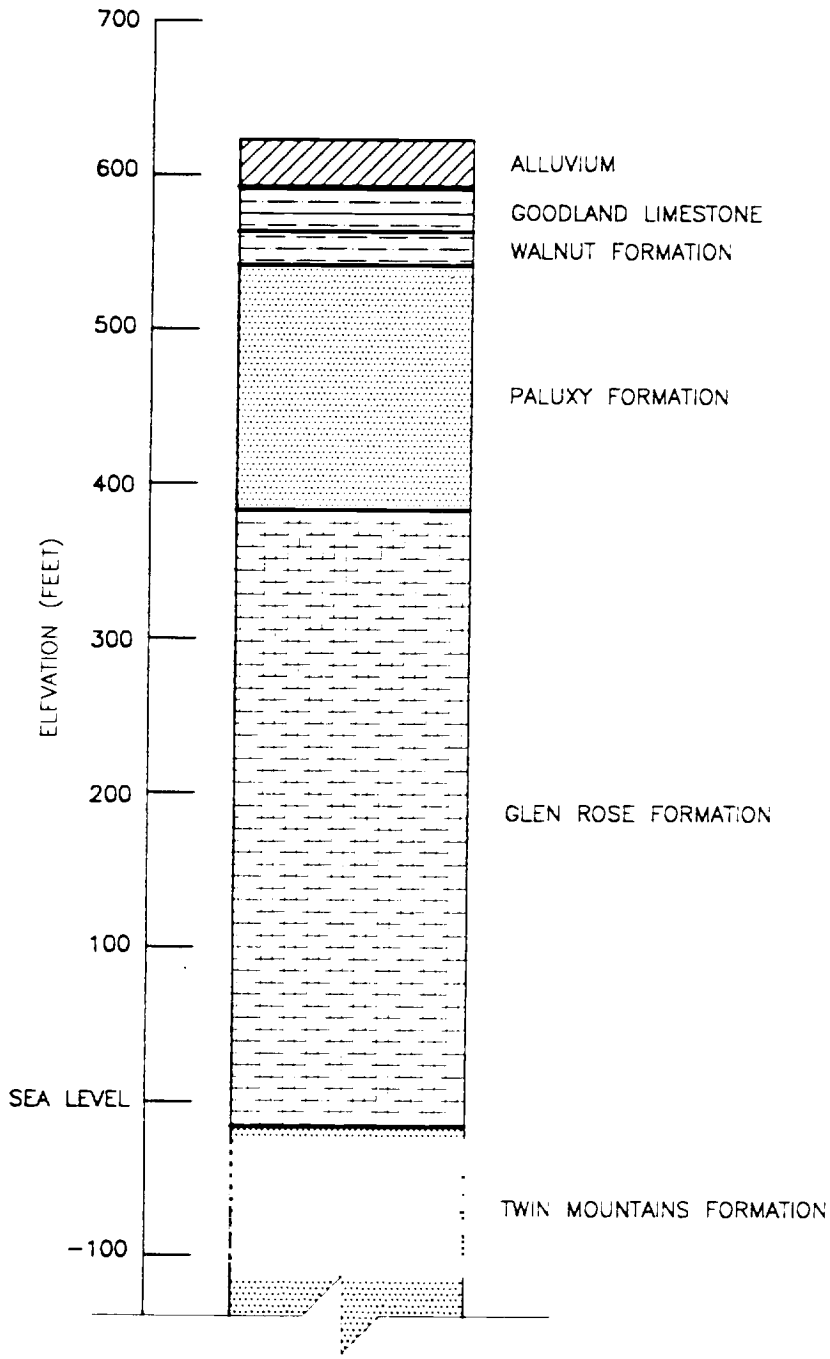

Figure 2.2-2
STRATIGRAPHIC COLUMN

SOURCE: ESE

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Figure 2.2-3
GEOLOGIC MAP

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A description of the pertinent characteristics of the stratigraphic units is provided in Table 2.2-2 and the following text.

2.2.5.1 Quatranary Alluvium

These deposits occur over most of the site, with the exception of the western edge of AFP4 where the Walnut Formation is exposed and along the southern portion where the Goodland Limestone is exposed. The thickness of these materials is variable, ranging from 0 foot (ft) in the outcrop areas to almost 60 ft beneath the East Parking Lot.

The Quatranary period alluvium (Holocene epoch) occurs downstream from the Lake Worth Dam in the current floodplain of the West Fork of the Trinity River, east of the facility. Older alluvial deposits and Terrace Deposits (Pleistocene Epoch) make up the flat plain on which the study area lies. These materials are poorly to moderately sorted, heterogeneous interbedded clay, silt, sand, and gravel.

Fill material is included within these deposits on the facility property, occurring primarily in landfills, waste pits, excavated areas, and areas where the surface was regraded or altered in support of construction activities. This material typically contains mixtures of clay, silt, sand and gravel but may also contain debris and other waste and ranges in thickness up to 20 ft in places.

The subsurface investigations have located troughs and channels that are eroded into the top of the bedrock at the Assembly Building, the East Parking Lot, and beneath the flightline. These features, which probably mark the former position of surface drainage features, are filled with sand and gravel deposits ranging in thickness from 15 to 35 ft.

Table 2.2-2. Stratigraphy of Tarrant County, Texas Area

System	Series and Group	Stratigraphic Unit	Thickness (Ft)	Rock Characteristics	Water-Bearing Properties
Quaternary	Recent and Pleistocene	Alluvium	0-45	Sand, gravel, clay, and silt.	Small to moderate yields. Unsatisfactory as a potable source unless treated.
Cretaceous	Gulf Series	Eagle Ford Shale	0-200	Blue-black shale; thin-bedded sandstone and limestone.	Not known to yield water in Tarrant County area.
		WOODBINE FORMATION Louisville Member	0-200+	Sandstone, clay and sandy clay, lignite, and gypsum.	Yields small quantities of water. Generally highly mineralized.
		Dexter Member	0-110	Fine-grained sandstone, clay, and sandy clay.	Less mineralized than Louisville Member. Important potable source in eastern Tarrant County.
	Comanche Series Washita Group	Grayson Shale	0-85	Yellow-brown to blue-gray fossiliferous marl, clay, and limestone.	Not known to yield water in Tarrant County area.
		Main Street Limestone	0-45	Hard, white limestone and marl.	Not known to yield water in Tarrant County area.
		Pawpaw Formation	0-40	Red-brown shale.	Not known to yield water in Tarrant County area.
		Weno Clay	0-75	Blue-gray fossiliferous marl and limestone.	Not known to yield water in Tarrant County area.
		Denton Clay	0-35	Blue-gray marl, shell conglomerate in upper section.	Not known to yield water in Tarrant County area.
		Fort Worth Limestone	0-35	Alternating layers of fossiliferous limestone and marl.	Not known to yield water in Tarrant County area.
		Duck Creek Formation	0-90	Blue, fossiliferous limestone and marl.	Not known to yield water in Tarrant County area.

Table 2.2-2. Stratigraphy of Tarrant County, Texas Area (Continued, Page 2 of 2)

System	Series and Group	Stratigraphic Unit	Thickness (Ft)	Rock Characteristics	Water-Bearing Properties
	Comanche Series Fredericksburg Group	Kiamichi Formation	0-40	Blue and brown-yellow marl with thin beds of limestone and sandstone.	Not known to yield water in Tarrant County area.
		Goodland Limestone	0-130	White, fossiliferous limestone and blue-yellow marl.	Not known to yield water in Tarrant County area.
		Walnut Clay	0-28	Shell agglomerate, fossiliferous clay and limestone, sandy clay, and black shale.	Not known to yield water in Tarrant County area.
	Comanche Series Trinity Group	Paluxy Sand	140-190	Fine-grained sand, shale, sandy shale, and lignite.	Major source for potable and industrial uses.
		Glen Rose Limestone	250-450	Fine-grained limestone, shale, marl, and sandstone.	Used as potable source in some parts of western Tarrant County.
		Twin Mountain Formation	250-450	Coarse to fine-grained sandstone, red shale, and red to yellow clay at the base.	Principal aquifer in Tarrant County. Yields large quantities for both potable and industrial uses. Water in upper portion may be highly mineralized east of Forth Worth.
Pennsylvanian	Undifferentiated		6,000-7,000	Gray sandy shale, tight, quartzitic sandstone, and black limestone.	Not tested. Not thought to contain fresh water.

Source: Radian, 1986 (From E. R. Leggat).

2.2.5.2 Goodland Limestone

The Goodland Limestone is exposed on the southern portion of the study area, south of White Settlement Road. This formation was encountered all across the study area, with the exception of the northwest portion of AFP4 and the northern portion of CAFB. The thickness of the formation ranges from 20 to 25 ft, where present. The Goodland is a chalky-white, fossiliferous limestone and marl that is highly weathered on its surface.

2.2.5.3 Walnut Formation

The Walnut Formation is exposed in a small area in the northwest corner of the study area along the shores of Lake Worth and Meandering Road Creek. This formation ranges in thickness from 25 to 35 ft across the site, with the exception of a few thinner areas where erosion has occurred. One notable erosional feature, which has been named the Window Area, occurs beneath the East Parking Lot. The Walnut Formation is a shell agglomerate limestone with varying amounts of clay and shale.

2.2.5.4 Paluxy Formation

The Paluxy Formation (or Paluxy Sand) underlies all of the study area outcropping only along the Lake Worth shoreline northwest of AFP4. The formation consists of several thick sandstone layers that are separated by thin, discontinuous shale and claystone layers. The thickness of individual layers within the formation varies across the site, and investigations completed to date have divided the formation into upper, middle, and lower units for monitor well installation and groundwater contamination monitoring. Deep boreholes and geophysical logging have revealed only one unit of this formation (a shale/silty shale bed) which can be extensively mapped across the site. Total formation thickness ranges from 130 to over 175 ft. Sandstones of the formation are primarily a fine- to coarse-grained sand with minor amounts of clay, sandy clay, pyrite, lignite, and shale.

2.2.6 GEOLOGIC STRUCTURE

The study area is situated on the relatively stable Texas craton, west of the faults that lie within the Ouachita Structural Belt. No major faults or fracture zones have been mapped near the base. The regional dip of the important stratigraphic units in the area is between 35 and 40 ft per mile in an easterly to southeasterly direction. The stratigraphic and structural relationships of the important geologic units in the area are illustrated in Figure 2.2-4, which portrays a generalized cross section from east to west across the study area.

2.2.7 GROUNDWATER

On the basis of their water-bearing properties, the geologic units in the study area can be divided into the following five hydrogeologic units (listed from most shallow to deepest): (1) an upper perched-water zone occurring in the alluvial terrace deposits left by the Trinity River; (2) an aquitard of predominantly dry limestone of the Goodland and Walnut Formations; (3) the Paluxy aquifer located within in the Paluxy sand; (4) an aquitard of relatively impermeable limestone in the Glen Rose Formation; and (5) a major aquifer in the sandstone of the Twin Mountains Formation. The Paluxy aquifer is the principal water source of White Settlement and other surrounding municipalities. Each of these units is examined in more detail in the following paragraphs.

2.2.7.1 Upper Zone

The uppermost groundwater in the area occurs within the pore space of the grains of coarse sand and gravels deposited by the Trinity River. In some parts of Tarrant County, primarily in the those areas adjacent to the Trinity River, groundwater from the Upper Zone is used for irrigation and residential use. Groundwater from the Upper Zone is rarely used as a source for potable water due to its limited distribution and susceptibility to surface/stormwater pollution. The storage capabilities of these deposits is minimal due to their limited areal and vertical extent and by the fact that the coarser-grained units are isolated into narrow lenses.

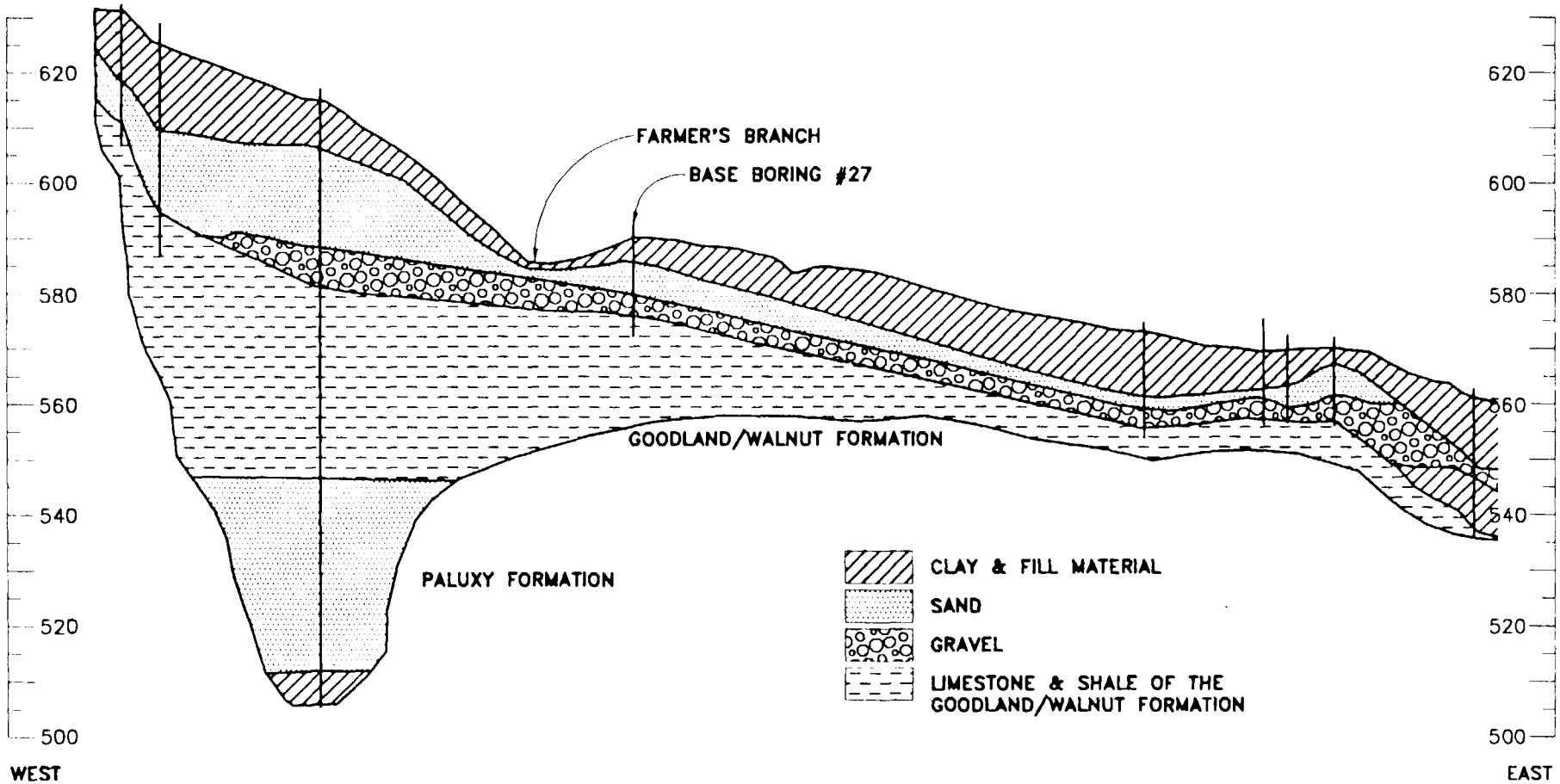

Figure 2.2-4
GENERALIZED LITHOLOGICAL CROSS SECTION

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Recharge to the water-bearing deposits occurs through infiltration from precipitation and from surface water bodies. Extensive pavement and construction in the study area restrict this recharge. However, additional recharge at the study area comes from leakage in water supply lines, sewer systems and cooling water systems. This leakage has been calculated to be in excess of 115.5 million gallons [316,000 gallons per day (gpd)] for 1991 (GD Facility Management, 1992). This inflow of water to the shallow aquifer locally affects groundwater flow patterns and contaminant transport, along with increasing the hydraulic head, which acts as the force to potentially drive water into lower aquifer systems. This flow between aquifers is typically restricted by the Goodland Limestone and the Walnut Formation. However, increased head can overcome this aquitard in areas where these formations are thin or absent.

The primary water flow in the Upper Zone is generally eastward toward the West Fork of the Trinity River, although localized variations exist across the study area. The hydraulic gradient across the study area is variable, reflecting variations in the flow direction and localized recharge. Ranges in the gradient are calculated between 0.004 to 0.2 feet per foot (ft/ft). A generalized potentiometric map of the Upper Zone is presented in Figure 2.2-5.

Slug tests were conducted on 25 of the shallow monitor wells to determine the hydraulic conductivity of the aquifer. Although these data only reflect the hydraulic conductivity of a localized area surrounding the tested well, averaging data across a site can provide a generalized site-wide number to be used for site wide flow calculations. As expected in an aquifer of this type, variability can be seen in the hydraulic conductivity across the site, with results ranging from 1.01E-02 centimeters per second (cm/sec) to 9.76E-06 cm/sec. These data lead to a calculated groundwater flow rate that ranges between 0.05 feet per day (ft/day) to 4.51 ft/day (GeoTech, 1992). Discharge from the aquifer occurs as seeps into streams and rivers and minimal discharge to the Paluxy Aquifer through the aquitard.

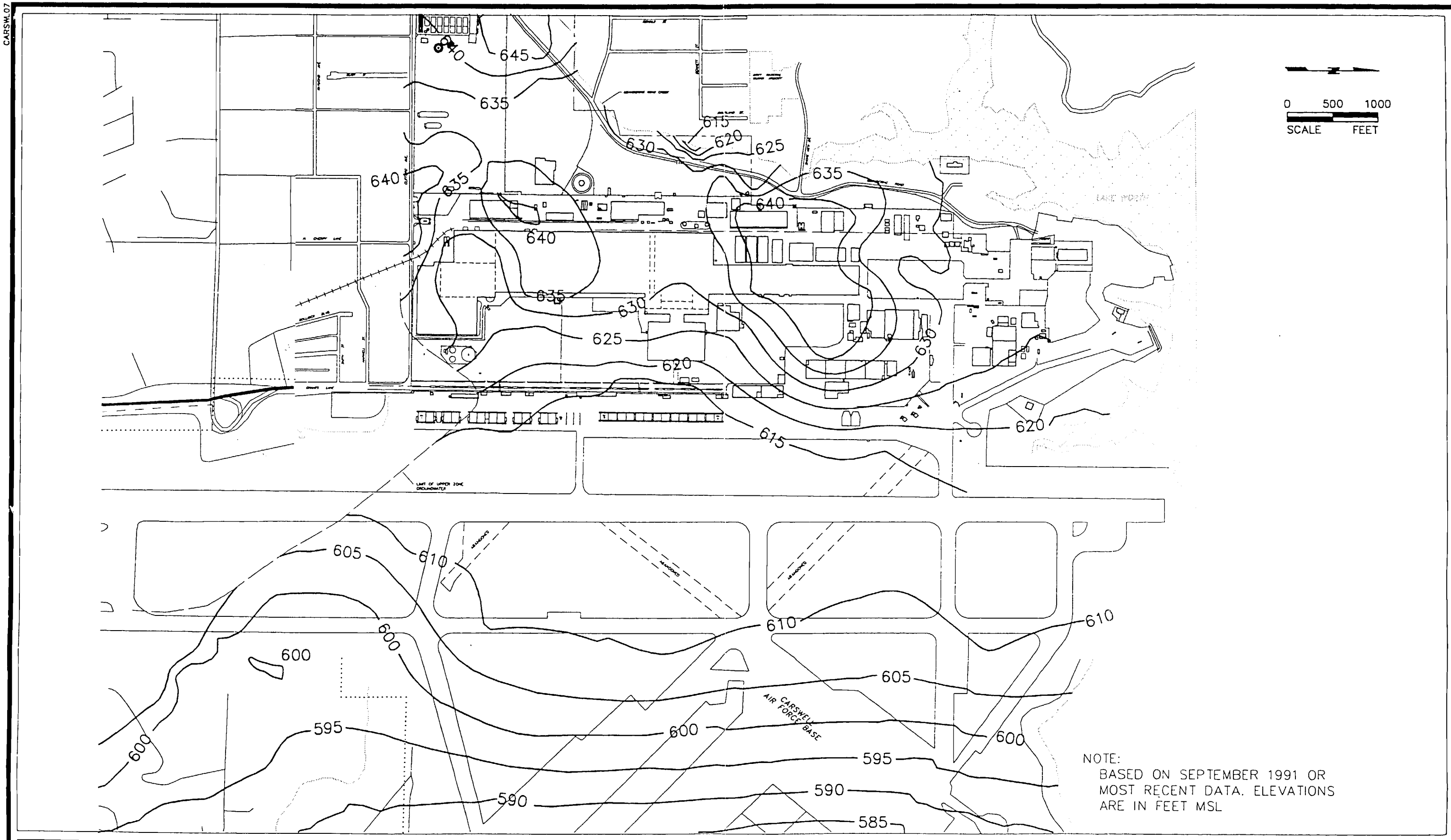

Figure 2.2-5
CONTOUR MAP OF UPPER ZONE WATER TABLE ELEVATIONS

SOURCE: ESE, CH GEOTECH

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2.2.7.2 Goodland/Walnut Aquitard

The groundwater within the Upper Zone is isolated from groundwater within the lower aquifers by the low permeability rocks of the Goodland Limestone and Walnut Formation. The primary inhibitors to vertical groundwater movement within these units are the fine-grained clay and shale layers that are interbedded with layers of limestone. Some groundwater movement does occur between the individual bedding planes of both of these units, but the vertical hydraulic conductivity has been calculated to range between 1.2E-09 to 7.3E-11. This corresponds to a vertical flow rate that ranges between 1.16E-03 to 5.22E-03. The thickness of the Goodland/Walnut aquitard averages approximately 25 ft beneath the study area, although is has been found to be less than 6 ft thick in vicinity of the Window Area. Evidence of contamination in the Paluxy aquifer in this vicinity suggests that even with the low vertical flow rate, the erosion of the aquitard in this area has allowed for cross connection of the water-bearing zones.

2.2.7.3 Paluxy Aquifer

The groundwater of the Paluxy aquifer is contained within the openings created by gaps between bedding planes, cracks, and fissures in the sandstone of the Paluxy Formation. Although it is reportedly composed of three zones of flow separated by thin aquitards, the aquifer behaves largely as a single unconfined to semiconfined aquifer.

The overall thickness of the Paluxy Formation ranges from 140 to 190 ft and averages 160 ft in Tarrant County. The Paluxy Formation is divided into upper and lower sand members and the aquifer is likewise divided into upper and lower aquifers. The upper sand is finer-grained and contains a higher percentage of shale than the lower sand. Therefore, most wells in the area are completed in the lower section. The groundwater within the Paluxy is under confined conditions where the overlying Goodland/Walnut rocks are present. Extensive pumping in the Fort Worth area has lowered the Paluxy potentiometric surface

below the top of the formation, resulting in a further reduction in the confined nature of the aquifer beneath the study area.

Recharge to the Paluxy aquifer occurs where the Paluxy Formation outcrops west of the Fort Forth area (Figure 2.2-6) and minimally from seepage from the overlying aquifer. Discharge from the aquifer is mainly the result of domestic, municipal, and industrial pumping in the surrounding region.

Regional groundwater flow within the Paluxy is eastward as presented in Figure 2.2-7. The groundwater flow is locally affected by the potentiometric high created by recharge from Lake Worth and by withdrawals by the community of White Settlement. This circumstance creates a more southeasterly groundwater flow direction beneath the study area.

The saturated thickness of the Paluxy ranges from 119 to 168 ft, resulting in transmissivities that range from 1,263 to 13,808 gallons per day per foot (gpd/ft) and an average of 3,700 gpd/ft. Permeabilities range from 13 to 140 gallons per day per square foot (gpd/ft^2) (based on an estimated approximate thickness for the aquifer of 100 ft). Well yields within the Paluxy aquifer average approximately 100 gallons per minute (gpm). This yield, in addition to the quality of the groundwater, makes the Paluxy one of the most important potable water sources in northeast Texas.

Slug tests were conducted on four of the monitor wells completed in the aquifer during the remedial investigation (RI) (GeoTech, 1992) to determine the hydraulic conductivity of the aquifer. Little variability is seen in the hydraulic conductivity from these wells, with results ranging from 1.83E-03 cm/sec to 6.63E-04 cm/sec. Additional hydraulic conductivity estimates were determined by Hargis & Associates, Inc. (1985) using pump tests. These data ranged from 2.7E-02 cm/sec to 4.7E-03 cm/sec, which leads to a calculated groundwater flow rate that ranges between 0.26 ft/day to 0.79 ft/day (GeoTech, 1992).

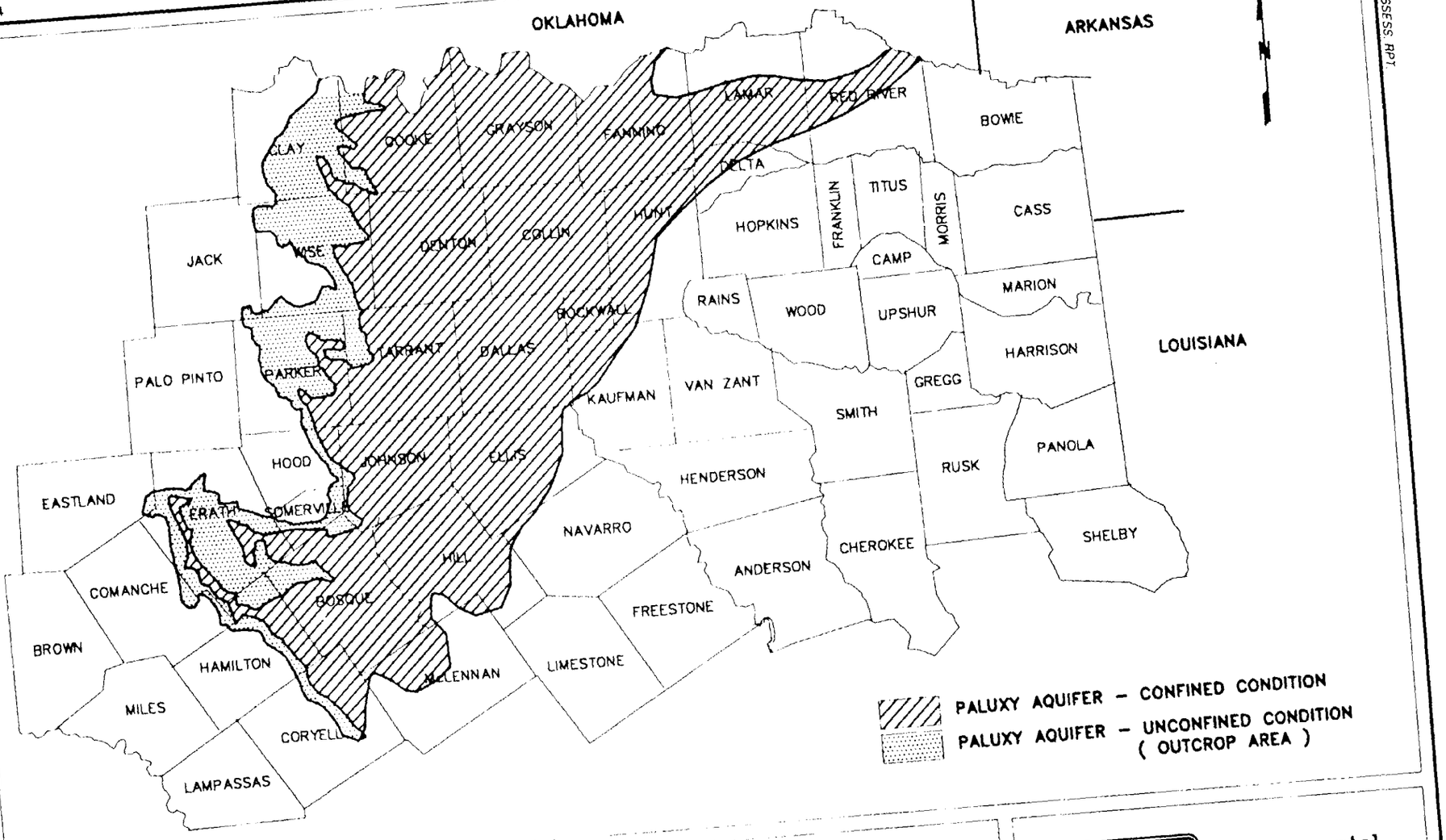

Figure 2.2-6
AREAL EXTENT OF PALUXY AQUIFER–NORTHEAST TEXAS REGION

ESE Environmental Science & Engineering, Inc.
A GLOOMP Company

FT. WORTH ASSESS. RPT.

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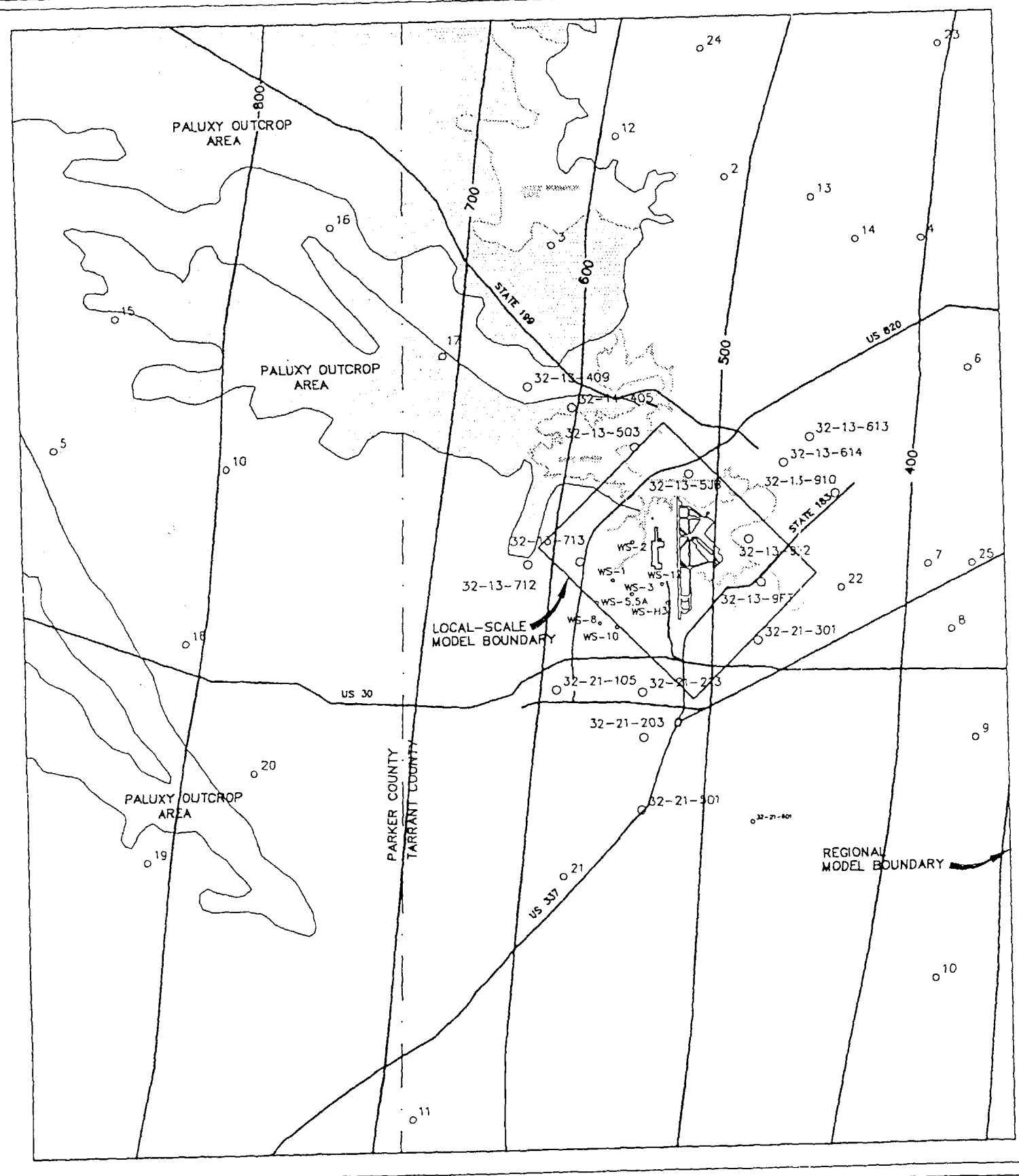

0 7500 15000
SCALE FEET

LEGEND

WS-3	WHITE SETTLEMENT PRODUCTION WELLS
32-13-614	PRODUCTION WELL IDENTIFIED IN STATE WELL RECORDS
1	PRODUCTION WELL LOCATION OBTAINED FROM NORDSTROM (1982).

NOTE: ELEVATIONS ARE IN FEET MSL
SOURCE: NORDSTROM, 1982.

Figure 2.2-7
CONTOUR MAP OF REGIONAL HEAD IN THE PALUXY AQUIFER, 1989

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SOURCE: ESE, CN GEOTECH

2.2.7.4 Glen Rose Aquitard

Below the Paluxy aquifer is an approximately 450-ft-thick section of fine-grained limestone, shale, marl, and sandstone of the Glen Rose Formation. Although the sands in the Glen Rose Formation yield small quantities of groundwater in the area, the limited porosity and permeability of this unit restricts the vertical flow of groundwater.

2.2.7.5 Twin Mountains Aquifer

The Twin Mountains Formation is the deepest source of groundwater within the study area. The Twin Mountains Formation consists of a basal conglomerate of chert and quartz and grades upward into a coarse- to fine-grained sand interbedded with shale. The thickness of the formation varies between 250 and 430 ft across the area. Recharge to the Twin Mountains aquifer occurs west of Fort Worth, where the formation crops out at the surface. As with the Paluxy, regional direction of groundwater movement within the Twin Mountains is eastward in the downdip direction. Also like groundwater within the Paluxy, Twin Mountains water occurs under water-table conditions in its recharge areas and becomes confined as the water moves downdip.

The Twin Mountains aquifer is the principal aquifer in Tarrant County. The formation yields large water supplies for municipal and industrial purposes. Groundwater withdrawals from the Twin Mountains aquifer, primarily for municipal water supply, have resulted in declining water levels. Between 1955 and 1976, the potentiometric surface of the aquifer dropped approximately 250 ft. Water quality in the Twin Mountains aquifer is suitable for potable use throughout the Fort Worth area. Water in the upper sands of the aquifer are considered too mineralized for human consumption.

Transmissivities in the Twin Mountains aquifer range from 1,950 to 29,700 gpd/ft and average 8,450 gpd/ft in Tarrant County. Permeabilities range from 8 to 165 gpd/ft^2 and average 68 gpd/ft^2 in Tarrant County.

2.2.8 SURFACE HYDROLOGY

The study area is located within the Trinity River basin. Lake Worth is a manmade reservoir, created through the damming of the Trinity River. Most of the surface drainage on the study area is intercepted by a series of storm drains and culverts, where it is directed to oil/water separators before being discharged into the West Fork Trinity River downstream of Lake Worth. The Farmers Branch drains the southern half of the study area and, in turn, discharges into the Trinity River. A small portion of the north end of CAFB drains into Lake Worth. Farmers Branch originates within the community of White Settlement and flows eastward. Just south of AFP4, Farmers Branch flows under the runway within two large culverts. A small portion of the north end of the study area drains into Lake Worth.

2.2.9 ECOLOGICAL SYSTEMS

Approximately 10 to 20 percent of the land included within the boundary of the study area is considered unimproved, indicating the existence of semi- to natural ecological conditions. The native vegetation in the areas is characterized by alternating bands of prairie grassland and woodlands. The higher elevations on the study area is covered by native and cultivated grasses such as little blue stem, indian grass, big bluestem, side-oats grama, and buffalo grass. Forested areas occur primarily in the lower-lying areas along the banks of surface water bodies. Common wood species include oak, elm, pecan, blackberry, and sumac. Several nonnative species, including catalpa and chinaberry, are also represented.

The most prevalent wildlife species include the black-tailed jack rabbits, cottontail rabbits, gray squirrels, and opossums. Common birds include mourning doves, meadowlarks, grackles, and starlings. A significant population

of game fish, including black bass, sunfish, and catfish, are present within the water of the small ponds that dot the area and Lake Worth.

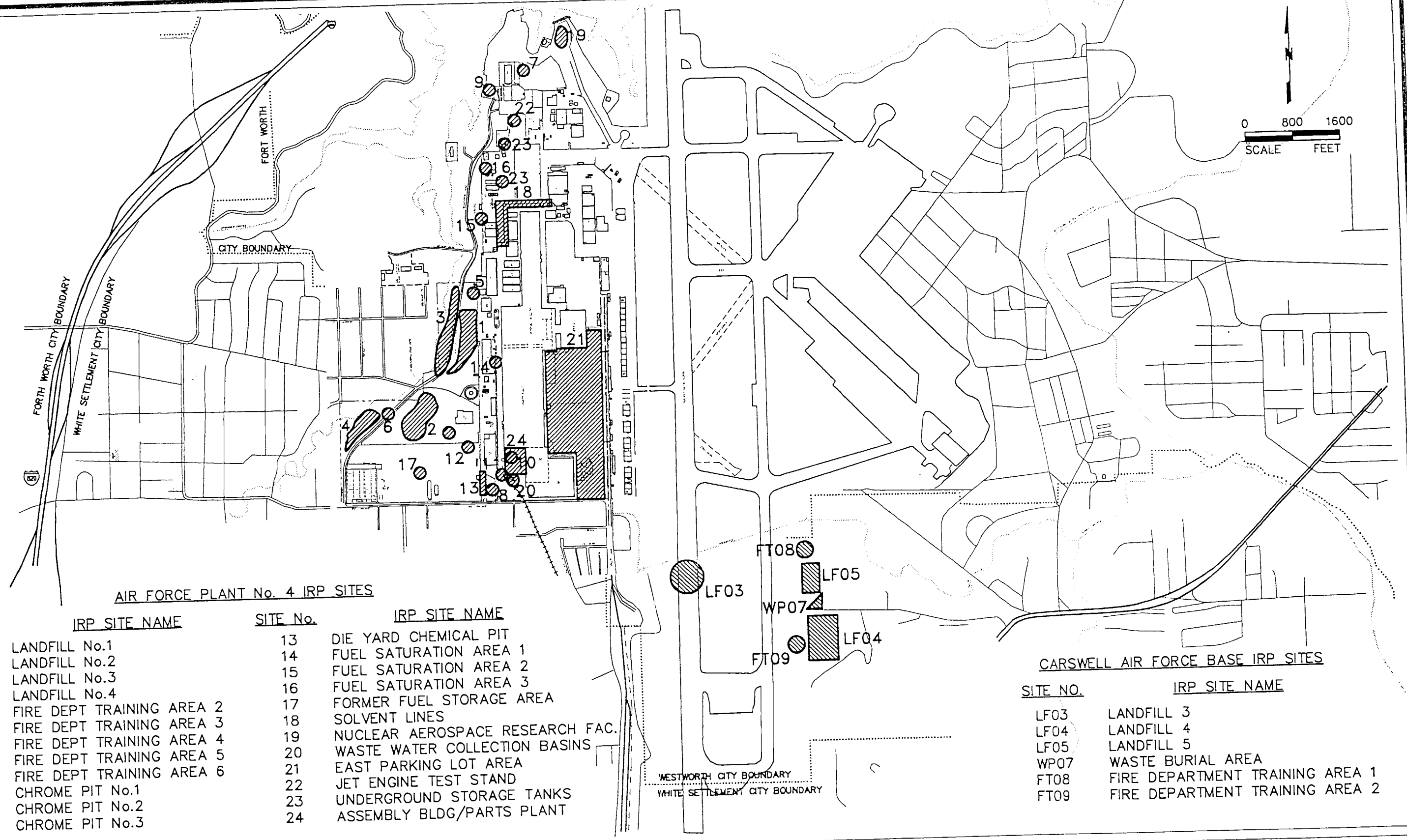
3.0 SUMMARY OF ASSESSMENTS

The literature review revealed that assessments were conducted at 38 individual locations at AFP4 and CAFB. The assessments were completed during IRP activities and non-IRP-related studies. Twenty-four of the sites are located at AFP4, and the remaining fourteen are located on CAFB. The following sections summarize assessment activities at the 38 individual sites. Section 3.1 summarizes assessment activities that were completed at AFP4. Section 3.2 summarizes assessment activities which were completed at CAFB. Figure 3.0-1 shows the IRP site locations for AFP4 and CAFB.

3.1 SUMMARY OF AFP4 ASSESSMENT PROJECTS

Prior to the initiation of the IRP at AFP4, GD conducted a Phase I investigation of subsurface contamination. The Phase I investigation was conducted at specific AFP4 locations which could be possible sources of contamination. A majority of soil borings and monitor wells installed during the Phase I investigation were located at the IRP-designated disposal sites. The IRP for AFP4 was initiated in March 1984 with the completion of the records search. At the time of the records search, CH2M Hill identified 20 possible disposal and spill sites at AFP4. The original IRP sites are as follows:

1. Site #1--LF01
2. Site #2--LF02
3. Site #3--LF03
4. Site #4--LF04
5. Site #5--FDTA 2
6. Site #6--FDTA 3
7. Site #7--FDTA 4
8. Site #8--FDTA 5
9. Site #9--FDTA 6
10. Site #10--Chrome Pit No. 1
11. Site #11--Chrome Pit No. 2



AIR FORCE PLANT No. 4 IRP SITES

SITE No.	IRP SITE NAME
1	LANDFILL No.1
2	LANDFILL No.2
3	LANDFILL No.3
4	LANDFILL No.4
5	FIRE DEPT TRAINING AREA 2
6	FIRE DEPT TRAINING AREA 3
7	FIRE DEPT TRAINING AREA 4
8	FIRE DEPT TRAINING AREA 5
9	FIRE DEPT TRAINING AREA 6
10	CHROME PIT No.1
11	CHROME PIT No.2
12	CHROME PIT No.3
13	DIE YARD CHEMICAL PIT
14	FUEL SATURATION AREA 1
15	FUEL SATURATION AREA 2
16	FUEL SATURATION AREA 3
17	FORMER FUEL STORAGE AREA
18	SOLVENT LINES
19	NUCLEAR AEROSPACE RESEARCH FAC.
20	WASTE WATER COLLECTION BASINS
21	EAST PARKING LOT AREA
22	JET ENGINE TEST STAND
23	UNDERGROUND STORAGE TANKS
24	ASSEMBLY BLDG/PARTS PLANT

CARSWELL AIR FORCE BASE IRP SITES

SITE NO.	IRP SITE NAME
LF03	LANDFILL 3
LF04	LANDFILL 4
LF05	LANDFILL 5
WP07	WASTE BURIAL AREA
FT08	FIRE DEPARTMENT TRAINING AREA 1
FT09	FIRE DEPARTMENT TRAINING AREA 2

Figure 3.0-1
IRP SITE LOCATIONS FOR AIR FORCE PLANT 4 & CARSWELL AIR FORCE BASE

SOURCE: ESE, CH GEOTECH

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12. Site #12--DP12
13. Site #13--DP13
14. Site #14--FSA-1
15. Site #15--FSA-2
16. Site #16--FSA-3
17. Site #17--Former Fuel Storage Area (FFSA)
18. Site #18--Solvent Lines
19. Site #19--Nuclear Aerospace Research Facility (NARF) Area
20. Site #20--Wastewater Collection Basins

During IRP Phase II activities, four additional areas were determined to be areas of environmental concern:

21. Site #21--East Parking Lot
22. Site #22--Jet Engine Test Stand (JETS)
23. UST Sites
24. Assembly Building/Parts Plant

The following section summarizes assessment activities for the aforementioned sites, specifically subsurface exploration. Reports which contain site-specific information for all of the aforementioned sites are shown in Table 3-1.1.

3.1.1 LF01

From 1942 to approximately 1966, LF01 was used for disposal of much of the study area's wastes, which is located west of Facilities Building 14. This site, which encompasses about 6 acres, is presently the site of the West Parking Lot (Figure 3.1-1).

The majority of the waste disposed of LF01 consisted of general refuse, rubble, plaster, lumber, and fill dirt. Potentially hazardous wastes were also disposed of in the landfill. These wastes included drums of unspecified liquid waste, solvents, thinners, and paint waste from tank trucks. All of this waste was

Table 3-1.1. Summary of Remedial Assessment Reports, AFP4, Fort Worth, Texas

Remedial Assessments	IRP Sites											
	LF01	LF02	LF03	LF04	FDTA 2	FDTA 3	FDTA 4	FDTA 5	FDTA 6	Chrome Pit No. 1	Chrome Pit No. 2	Chrome Pit No. 3
Phase I, Investigation, Drilling, and Construction of Upper Zone Test Holes and Monitor Wells, H&M, 1983 (01001)	X		X									
Phase I Investigation of Subsurface Conditions at Plant 4, H&M, 1983 (01002)	X	X	X	X	X			X	X			X
Phase II Investigation of Subsurface Conditions at Plant 4, H&A, 1985 (01013)	X	X	X		X	X				X	X	X
IRP-Phase I - Record Search for Plant 4, CH2M Hill, 1984 (01011)	X	X	X	X	X	X	X	X	X	X	X	X
Draft Remedial Action Plans and Conceptual Documents for Fuel Saturation Areas No. 1 and 3, Intellus Corporation, 1986 (01025)												
Interim Report for Ten-Site Field Investigation, Intellus Corporation, 1987 (01026)	X		X		X			X	X	X	X	X
Summary of Window Area Investigation, H&A, 1987 (01028)												
Assessment Report for Landfill No. 3, Intellus Corporation, 1987 (01029)			X									
IRP Phase II-Confirmation/Quantification Stage I, Radian Corporation (01041)	X	X	X	X		X	X	X	X	X	X	X
Underground Storage Tank Program, Evaluation and Analysis of USTs at Plant 4, H&A, 1989 (1045)												
Evaluation of Condenser Water Pipeline and Interim Remedial Measures Fuel Sat. Area 3, H&A, 1988 (1043)												
Water Quality Data, May 1985 to May 1986, H&A, 1986 (03001)	X	X	X	X	X	X		X	X	X	X	X
Water Quality Data, May 1986 to May 1987, H&A, 1987 (03002)	X	X	X	X	X	X		X	X	X	X	X
Water Quality Data, May 1987 to January 1989, H&A, 1989 (03007)	X	X	X	X	X	X		X	X	X	X	X
Draft Final Groundwater Quality Data, Geotech, 1992 (01057)	X	X	X	X	X	X	X	X	X	X	X	X
Summary of Interim Remedial Investigations, H&A, 1989 (03010)	X		X									
Preliminary Assessment/Site Inspection and Remedial Investigation, Geotech, 1992 (NA)	X		X	X	X	X		X				X
Phase I, Investigation, Drilling, and Construction of Upper Zone Test Holes and Monitor Wells, H&M[1], 1983 (01001)	X											

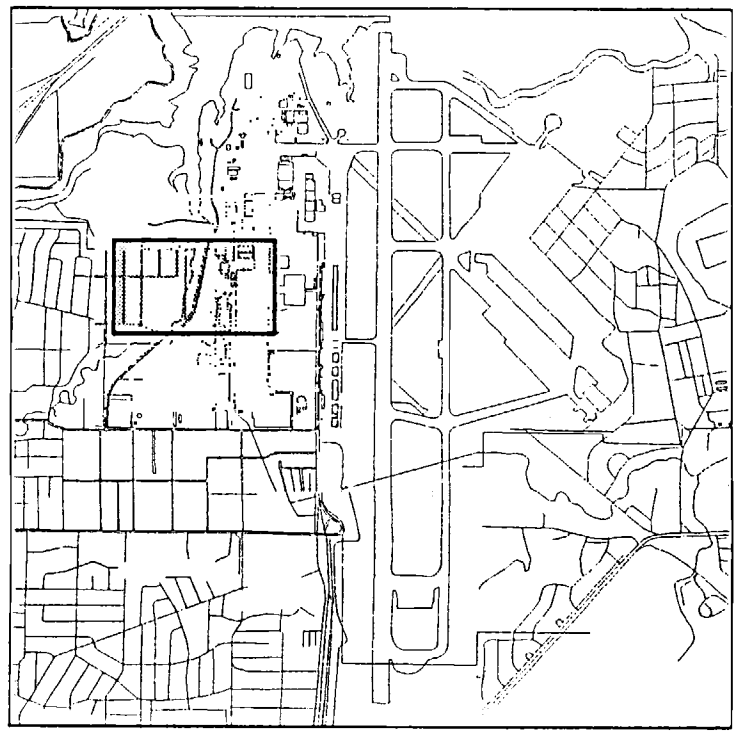
Table 3-1.1. Summary of Remedial Assessment Reports, AFP4, Fort Worth, Texas (Continued, Page 2 of 2)

Remedial Assessments	IRP Sites											
	DP13	FSA-1	FSA-2	FSA-3	Former Fuel Storage Site	Solvent Lines	Nuclear Aero-space Research Facility	Wastewater Collection Basins	East Parking Lot Area	Assembly Building/ Parts Plant	Jet Engine Test Stand	USTs
Phase I Investigation of Subsurface Conditions at Plant 4,	X											
Phase II Investigation of Subsurface Conditions at Plant 4, H&A[2], 1985 (01013)	X	X	X	X		X	X	X	X	X	X	
IRP-Phase I - Record Search for Plant 4, CH2M Hill, 1984 (01011)	X	X	X	X	X		X					
Draft Remedial Action Plans & Conceptual Documents for Fuel Saturation Areas No. 1 and 3, Intellus Corporation, 1986 (01025)		X		X								
Interim Report for Ten-Site Field Investigation, Intellus Corporation, 1987 (01026)	X		X					X		X		
Summary of Window Area Investigation, H&A, 1987 (01028)									X			
Assessment Report for Landfill No. 3, Intellus Corporation, 1987 (01029)												
IRP-Phase II-Confirmation/Quantification Stage I, Radian Corporation (01041)	X	X	X	X	X	X	X	X	X	X	X	X
UST Program, Evaluation and Analysis of USTs at Plant 4, H&A, 1989 (1045)				X								X
Evaluation of Condenser Water Pipeline and Interim Remedial Measures Fuel Sat. Area 3, H&A, 1988 (1043)				X								
Water Quality Data, May 1985 to May 1986, H&A, 1986 (03001)	X	X	X	X	X	X	X	X	X	X	X	
Water Quality Data, May 1986 to May 1987, H&A, 1987 (03002)	X	X	X	X	X	X	X	X	X	X	X	
Water Quality Data, May 1987 to January 1989, H&A, 1989 (03007)	X	X	X	X	X	X	X	X	X	X		
Draft Final Groundwater Quality Data, Geotech, 1992 (01057)	X	X	X	X	X	X	X	X	X	X	X	
Summary of Interim Remedial Investigations, H&A, 1989 (03010)				X					X	X		
Preliminary Assessment/Site Inspection and Remedial Investigation, Geotech, 1992 (NA)	X	X	X	X	X			X	X		X	X

Note: X = information pertaining to the site is contained in the remedial assessment report.
H&M = Hargis & Montgomery.
H&A = Hargis & Associates, Inc.

Source: ESE.

FIG311



KEYMAP

RONALD ST.

BOURLAND ST.

MEANDERING ROAD CREEK

CREEK SEEP

LANDFILL No.3

STORM SEWER OUTFALL

DRAINPIPE

FRENCH DRAIN No.1

FDTA No.2

LANDFILL No.1

PARKING LOT

92

88

14

ASSEMBLY BUILDING

PARTS PLANT

FSA No.1

USTS 19 AND 20 (REMOVED)

N

0 100 200

SCALE FEET

Figure 3.1-1
SITE MAP - LANDFILL NUMBER 1

SOURCE: ESE; CN GEOTECH

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dumped in shallow pits. Oils and fuels were also dumped in pits and subsequently burned. Aerial photographs show that at least five separate pits were located within LF01. Sludge from these pits was periodically dredged out and deposited in the landfill area. Other suspected wastes included mercury and magnesium waste, chromate sludges, and cyanide.

LF01 was closed in 1966, and the area was graded and paved for vehicle parking. Prior to the grading and paving, two 6-inch-diameter perforated pipes were laid on bedrock just east of Meandering Road. These pipes were installed to channel leachate from the landfill to a storm sewer outfall. In 1982, contaminants were identified in water samples collected from a storm drain; therefore, the original perforated pipes were rerouted to a collection basin and French Drain No. 1 was constructed.

In 1983, approximately 11,000 cubic yards (yd^3) of the landfill were excavated; the material was moved to an approved hazardous waste disposal facility (Chemical Waste Management's Carlyss, Louisiana facility) as an interim remedial action. French Drain No. 2 was constructed within the excavation to intercept contaminated groundwater. The excavation was then backfilled and the site repaved. Groundwater was collected from French Drain Nos. 1 and 2 and processed through a water treatment system at AFP4. Onsite treatment consisted of processing the fluid through a cooling tower to volatilize organic compounds, and discharging effluent to the City of Fort Worth sanitary sewer system. When the system was closed in May 1990, the pumping from the french drains was halted (Hargis & Associates, Inc., 1985). In 1992, water from the french drains was transported to the FSA-1 treatment system.

Subsurface assessment activities were conducted to determine the extent of contamination present in the soils and groundwater at LF01. Nineteen soil borings and thirteen monitor wells were installed during the following studies:

1. Phase I Investigation, Drilling and Construction of Test Holes and Monitoring Wells, Hargis & Montgomery, January 1983 (01001);
2. Phase I Investigation of Subsurface Conditions at Plant 4, Hargis & Montgomery, February 1983 (01002);
3. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, September 1985 (01013);
4. Ten-Site Field Investigation, Plant 4, Intellus Corporation, November 1986 (01026);
5. IRP Phase II, Confirmation/Quantification Stage I, Radian Corporation, December 1987 (01041);
6. Summary of Interim Remedial Action, January 1987 to April 1989, Hargis & Associates, Inc., July 1989 (03010); and
7. Preliminary Assessment/Site Inspection and Remedial Investigation (PA/SI/RI), Geotech, December 1992 (NA).

Summaries of these reports are included in Appendix A. Soil boring and monitor well locations are shown on Figure 3.1-2. Reports containing site-specific information pertaining to LF01 are shown on Table 3.1-1.

To determine hydrologic properties and groundwater quality in the upper zone flow system in the LF01 area, the following monitor wells were installed:

1. Wells HM-6, HM-7, and HM-10 (installed during Phase I investigation activities);
2. Wells HM-18, HM-19, HM-49, HM-50, and HM-62 (installed during Phase II investigation activities); and
3. Wells F-216 and F-217 (installed during ten-site investigation activities).

To determine groundwater quality in the Paluxy Formation, five Paluxy monitor wells were installed. Three Paluxy wells (Wells P-4, P-7U, and P-7M) were

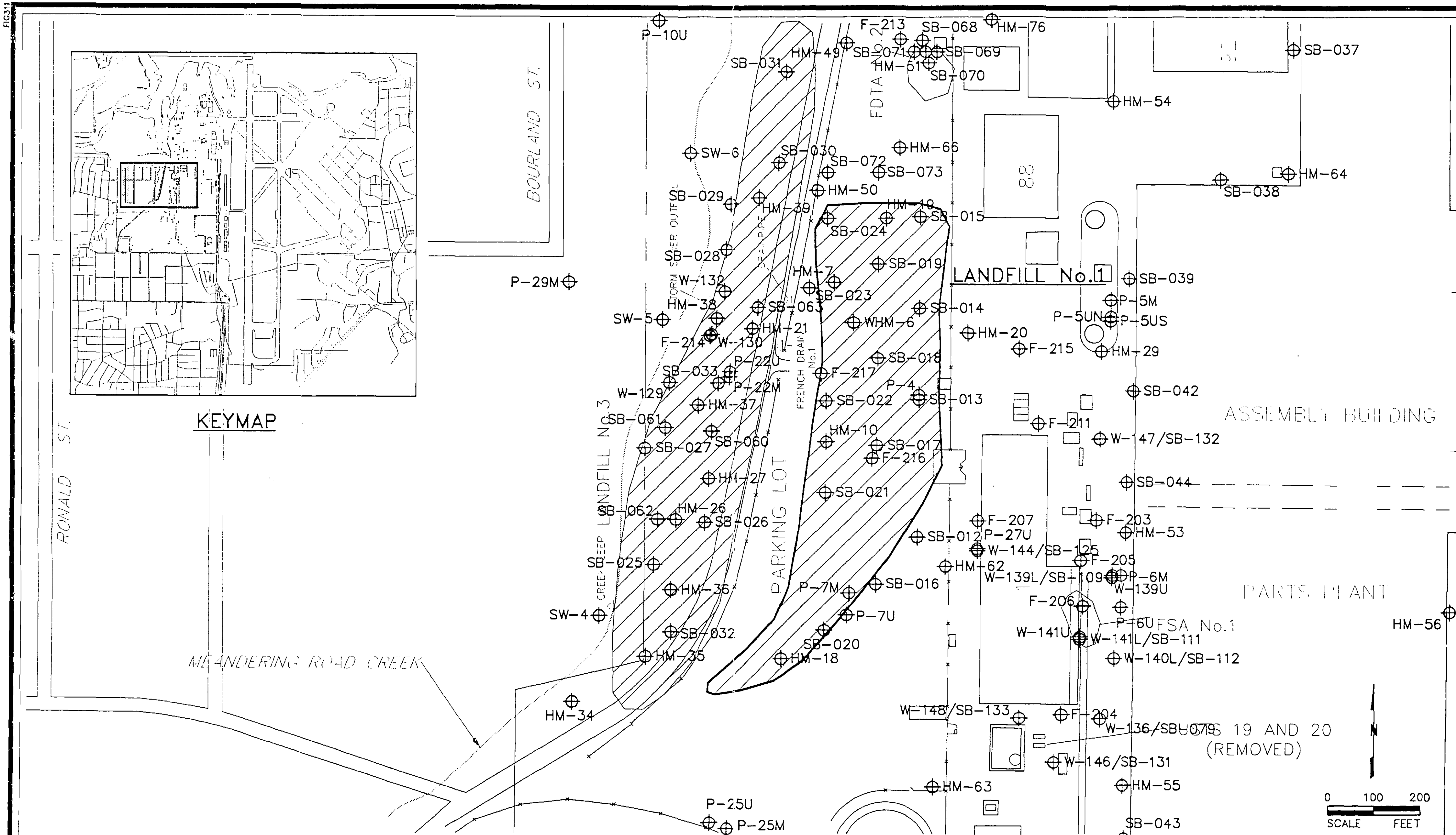

Figure 3.1-2
SAMPLE LOCATION MAP – LANDFILL NUMBER 1

SOURCE: ESE; CN GEOTECH

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installed during the Phase II investigation. Wells P-25U and P-25M were installed during the interim remedial investigations.

Groundwater and soil samples collected prior to the RI indicated that groundwater and soils at LF01 were contaminated with heavy metals, semivolatiles (SVOCs), and VOCs (primarily solvents). The MAP projects the Proposed Plan for LF01 will be completed in November 1993, and the final ROD will be completed by June 1994.

During the RI, 16 soil borings were installed to characterize and determine the extent of contamination. Soil samples submitted for analysis indicate that VOCs, SVOCs, and inorganics are present in the soil at LF01. High levels of solvents and solvent degradation products are present in areas of LF01. Fuel related contaminants were found in the western part of the landfill downgradient of the former waste oil pits, and inorganic contaminants were detected irregularly across the site. The estimated volume of soils contaminated with solvents is approximately 83,000 yd^3; of this volume, an estimated 11,000 yd^3 are also contaminated with inorganics.

Groundwater samples collected during RI activities from the upper zone wells in LF01 indicate that the upper zone groundwater is contaminated with VOCs (primarily TCE and degradation products), SVOCs, and chromium. The groundwater in this area is part of the west plume as designated by the RI (Geotech, 1992).

3.1.2 LF02

LF02 originally consisted of some low areas and a livestock watering hole. Most of LF02 was reportedly filled with construction debris and fill dirt during the early 1940s. However, 1962 aerial photographs show some activity at the stock watering hole at LF02. LF02 was reportedly used for the disposal of lumber and tires, and was assumed to be periodically burned. No reports exist that indicate

that hazardous substances were disposed of at the site. The location of LF02 is shown on Figure 3.1-3.

Subsurface assessment activities were conducted to determine the extent of contamination present in the soils and groundwater at LF02. Seven monitor wells were installed and a terrain conductivity survey was completed during the following studies:

1. Phase I Investigation of Subsurface Conditions at Plant 4, Hargis & Montgomery, February 1983 (1002);
2. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, Inc., September 1985 (1013); and
3. IRP Phase II, Confirmation/Quantification, Stage I, Radian Corporation, December 1987 (1040).

Summaries of these reports are included in Appendix A. Reports containing specific information pertaining to LF02 are identified in Table 3.1-1.

To determine groundwater quality in the upper flow system, the following monitor wells were installed:

1. Well HM-2 (installed during Phase I investigation activities); and
2. Wells HM-22, HM-40, HM-42, HM-43, and HM-46 (installed during Phase II investigation activities).

One monitor well was installed to determine the groundwater quality in the Paluxy Formation. Well P-21u was installed during the IRP Phase II investigation (Radian, 1987). Monitor well locations are shown on Figure 3.1-4. Lithologic logs for the monitor wells are included in Appendix C.

A terrain conductivity survey was performed during the IRP Phase II investigation to determine the extent of shallow soils contamination. Numerous

FIG3.1.3

KEYMAP

LANDFILL No.4

FDTA No.3

LANDFILL No.2

LANDFILL No.2

FORMER
FUEL STORAGE
AREA

N

0 100 200
SCALE FEET

Figure 3.1–3
SITE MAP – LANDFILL NUMBER 2

SOURCE ESE, CN GEOTECH

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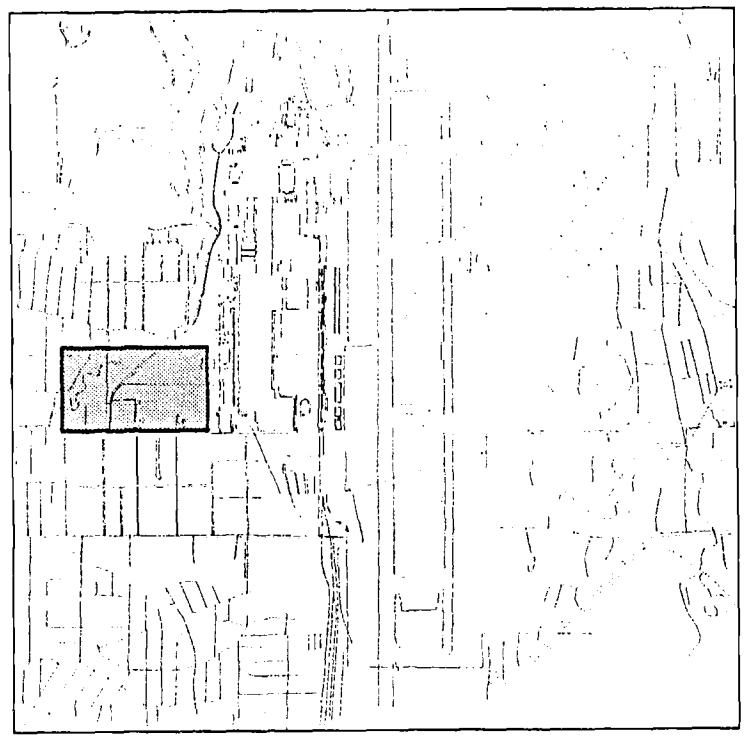
FIG313



KEYMAP

Figure 3.1-4
SAMPLE LOCATION MAP - LANDFILL NUMBER 2

SOURCE: ESE, CN GEOTECH

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anomalies were detected; explanations for anomalies include buried metals and possible soil contamination.

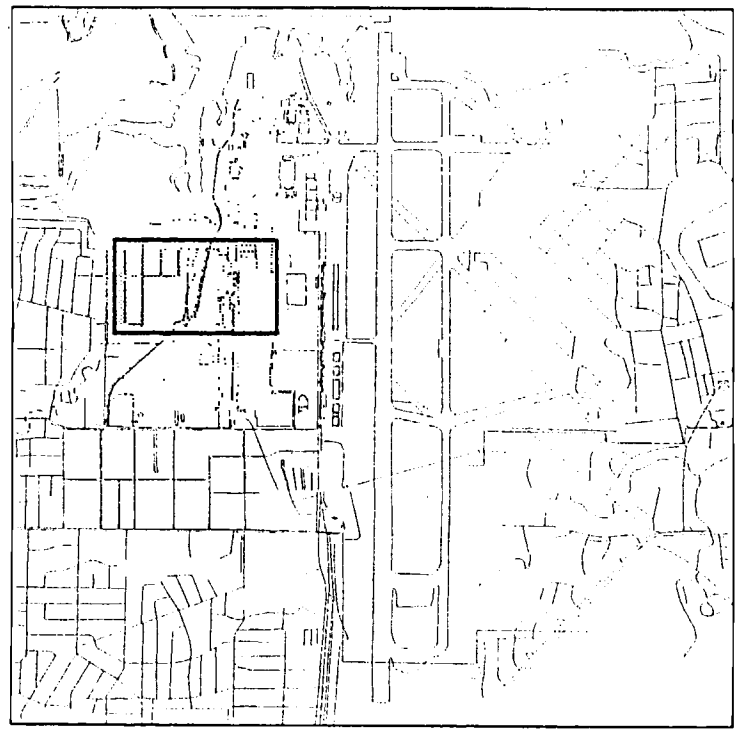
Groundwater samples collected from monitor wells installed within and around LF02 contained concentrations of lead and chromium exceeding MCL guidelines. Groundwater samples collected from the upper zone monitor wells did not contain concentrations of contaminants which exceeded MCL guidelines. The groundwater sample collected from Well P-21u contained 12 μg/L of toluene. The source of toluene is unknown, since no identified sources exist up gradient (Radian, 1987). The findings of the IRP Phase II investigation are consistent with the data presented by Hargis & Associates, Inc. which indicated that there is no organic contamination in the upper zone flow system at LF02 (Radian, 1987). Since no contamination was detected at LF02, a no further action status was granted.

3.1.3 LF03

LF03 encompasses approximately 3 acres west of LF01, adjacent to Meandering Road Creek (Figure 3.1-5). The landfill was used from 1942 to 1945 to dispose of various wastes including hazardous liquid wastes consisting of mixed oils and solvents. Some of these wastes were burned in a small pit in the landfill. From 1945 to 1966, the landfill was inactive. Fill dirt and rubble were used to fill and grade LF03 from 1966 to 1967.

Sample results from soil borings and groundwater monitor wells show that the soil contains anomalous concentrations of VOCs and petroleum hydrocarbons, and that the groundwater is contaminated with cyanide, metals, VOCs, SVOCs, fuel hydrocarbons, and oil and grease. Two monitor wells at LF03 once contained a large amount of fuel-related floating product and solvent-related free product.

FIG315



KEYMAP

LANDFILL No.3

RONALD ST.

BOWLING ST.

STORM SEWER OUTFALL

DRAINPIPE

FRENCH DRAIN No.1

CREEK SEEP

MEANDERING ROAD CREEK

PARKING LOT

FDTA No.2

FSA No.1

USTS 19 AND 20 (REMOVED)

88

14

ASSEMBLY BUILDING

PARTS PLANT

N

0 100 200

SCALE FEET

Figure 3.1-5
SITE MAP - LANDFILL NUMBER 3

SOURCE: ESE, CN GEOTECH

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The major contaminants appear to be confined to a relatively small area within LF03. Aerial photographs indicate that one area of concern was an open drainage channel extending from Bomber Road west to Meandering Road Creek. This channel contains a storm sewer that runs approximately east to west. The channel has been filled and leveled, covering the storm sewer.

Subsurface investigations were conducted to determine the extent of soils and groundwater contamination present at LF03. Twenty soil borings and sixteen monitor wells were installed during the following investigations:

1. Phase I Investigation, Drilling and Construction of Test Holes and Monitor Wells, Hargis & Montgomery, January 1983 (1001);
2. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, Inc., September 1985 (1002);
3. Ten-Site Field Investigation, Plant 4, Intellus Corporation, November 1986 (1026);
4. IRP Phase II Confirmation/Quantification, Stage I, Radian Corporation, December 1987 (1041);
5. Summary of Interim Remedial Investigations, January 1987 to April 1989, Hargis & Associates, Inc., July 1989 (3010); and
6. Preliminary Assessment/Site Inspection and Remedial Investigation, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. Reports containing specific information pertaining to LF03 are shown in Table 3.1-1.

To determine the hydrogeologic properties and groundwater quality in the upper flow system in the LF03 area, the following monitor wells were installed:

1. Wells HM-21, HM-26, HM-27, and HM-34 through HM-39 (installed during Phase II investigation activities);
2. Well F-214 (installed during the ten-site field investigation activities); and

3. Wells W-129, W-130, and W-132 (temporary wells installed during preliminary assessment/site inspection and remedial investigation activities).

To determine the hydrogeologic properties and groundwater quality in the Paluxy Formation, the following monitor wells were installed:

1. Wells P-10u and P-10m (installed during Phase II investigation activities);
2. Well P-22u (installed during IRP Phase II investigation activities);
3. Wells P-22m, P-24u, and P-24m (installed during interim remedial investigation activities); and
4. Well P-29m (installed during preliminary assessment/site inspection, remedial investigation activities).

Sample locations are shown on Figure 3.1-6. Lithologic logs for monitor wells are included in Appendix C.

Multiple organic contaminants (primarily solvents, fuels, and oil and grease) were detected in all water samples from all shallow monitor wells installed, and in Well P-22u during previous investigations.

Well F-214, installed by Intellus Corporation during the ten-site field investigation, contained a dense, nonaqueous phase liquid (DNAPL) phase consisting primarily of TCE. Soil samples collected from two soil borings drilled by Intellus Corporation contained solvents and petroleum hydrocarbons.

The subsurface investigation conducted during the RI indicated that soils were contaminated with organics and inorganics. VOCs were detected in soils at levels indicating the presence of free product in the center of LF03. The highest concentrations were detected in soil samples collected from the area of Well F-214. Groundwater from four seeps (Samples SW-7 through SW-11) were

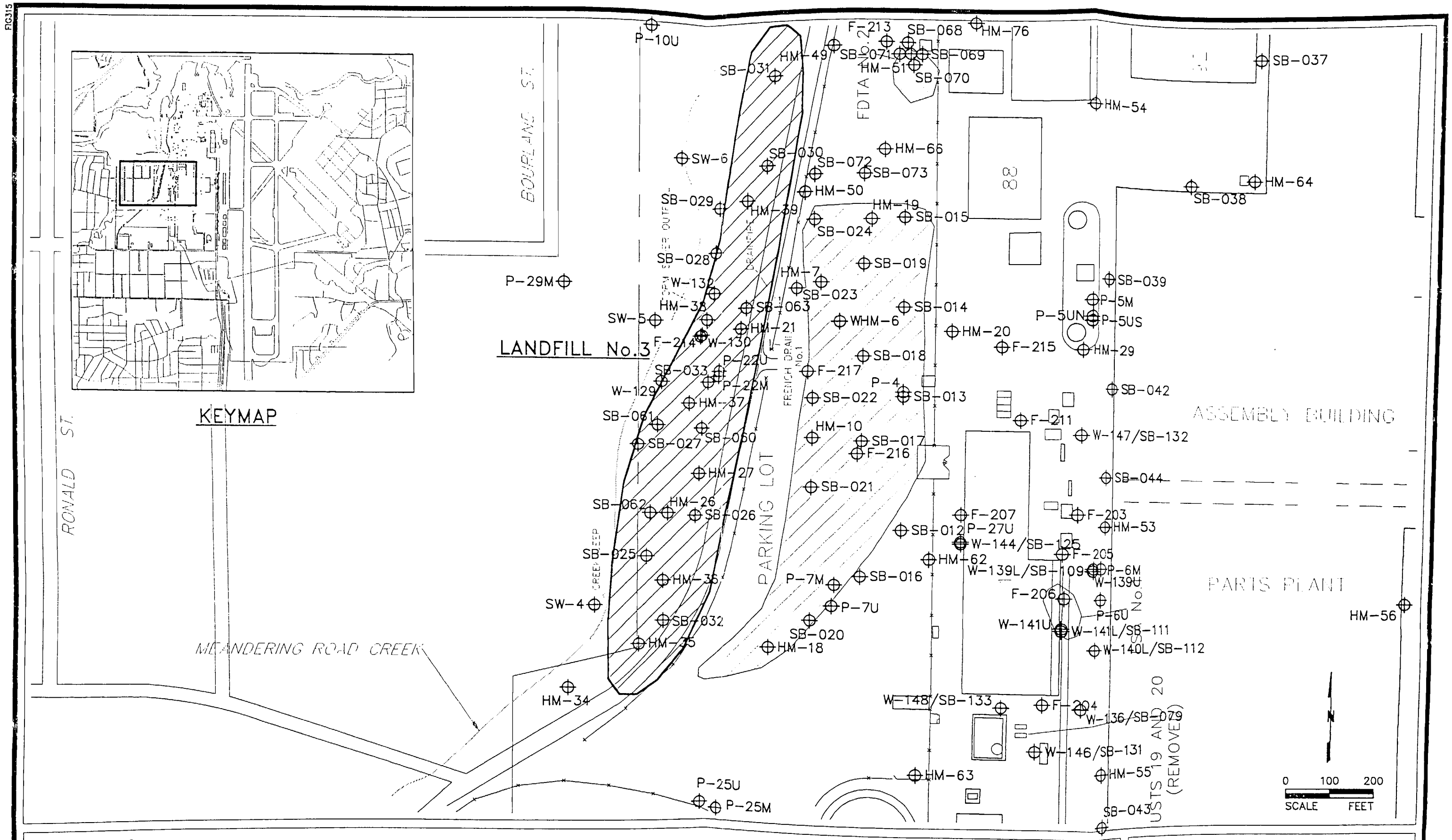


Figure 3.1-6
SAMPLE LOCATION MAP - LANDFILL NUMBER 3

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

sampled. Samples SW-8 and SW-9, collected from two seeps, contained VOCs (primarily solvents), and groundwater samples collected from Paluxy monitor wells at LF03 during the RI contained TCE. Concentrations of TCE varied from 2 to 100 μg/L. Groundwater samples collected from the upper zone monitor wells contained VOCs, SVOCs and fuel-related hydrocarbons.

The total amount of contaminated soil at LF03 is approximately 16,000 yd^3. Approximately 15,900 yd^3 of soil are estimated to be contaminated with organic compounds, and 3,800 yd^3 are estimated to be contaminated with inorganics.

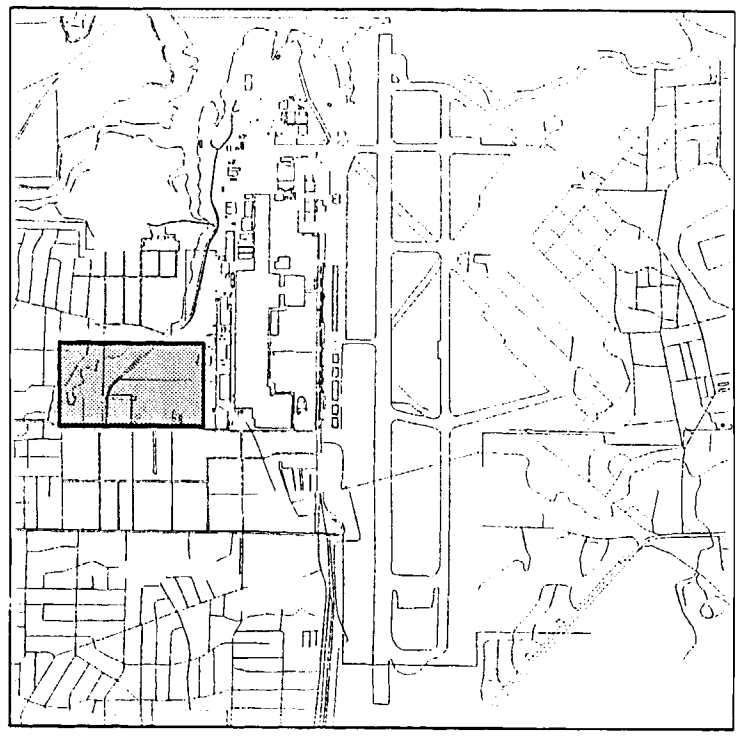
Groundwater samples collected from upper zone monitor wells contained VOCs (primarily TCE and degradation products), SVOCs, and chromium. Paluxy Wells P-22u and P-22m contained TCE. The contaminated groundwater in the upper zone flow system is part of the West Plume Area as designated in the RI (Geotech, 1992).

3.1.4 LF04

LF04 is located near the southwest boundary of APF4 (Figure 3.1-7). This landfill occupies approximately 2 acres west of Meandering Road. LF04 used a low area adjacent to Meandering Road Creek for the disposal of construction debris from 1956 to the early 1980s. Evidence suggests that other types of waste may have been disposed of in LF04 from 1966 to approximately 1973. These wastes may have included small quantities of hazardous waste such as solvents, oils, fuels, and thinners.

A product recovery system was installed in F-214. The product recovery system was taken out of service approximately 1 year after installation. Implementation of containment or vacuum extraction technologies is in advanced planning stages. Field studies to assess feasibility of vacuum extraction are scheduled for early 1994. The MAP projects the Proposed Plan for LF03 will be completed by November 1993, and a final ROD will be completed by June 1994.

FIG317



KEYMAP

LANDFILL No.4

LANDFILL No.4

FDTA No.3

LANDFILL No.2

FORMER
FUEL STORAGE
AREA

N

0 100 200
SCALE FEET

Figure 3.1-7
SITE MAP - LANDFILL NUMBER 4

SOURCE: ESE; CN GEOTECH

Environmental
Science &
Engineering, Inc.

VOCS and other compounds were reported during interviews, but were not confirmed in subsequent field investigations. On the basis of the IRP Phase II investigations, a no-further action remedial action alternative was recommended.

Soil samples were not collected at this site. Based on a review of the aerial photographs of LF04 when it was in use, it appears that materials other than construction debris were disposed of at LF04. Because LF04 is located on the Meandering Road Creek flood plain, a potential exists for the migration of contaminants into the surface waters of Meandering Road Creek.

Subsurface assessment activities were conducted at LF04 to determine the extent of contaminated present soils and groundwater. Five soil borings and three monitor wells were installed at LF04 during the following investigations:

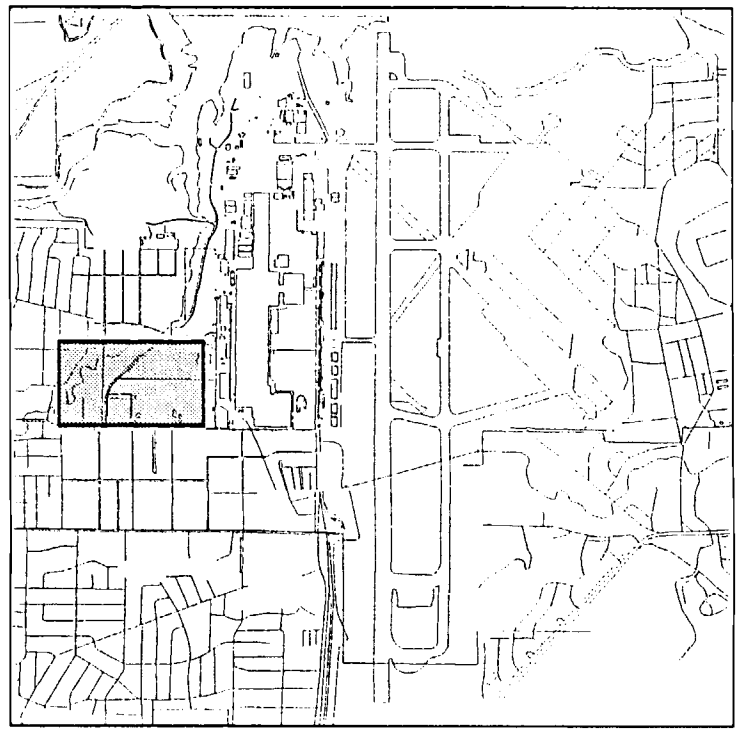
1. Phase I Investigation of Subsurface Conditions at plant 4, Hargis & Montgomery, February 1983 (1002);
2. IRP, Phase II Confirmation/Quantification, Stage I, Radian Corporation, December 1987 (1041); and
3. PA/SI/RI, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. Soil boring and monitor well locations are shown on Figure 3.1-8. Reports containing specific information pertaining to LF04 are shown in Table 3.1-1.

To determine hydrogeologic properties and groundwater quality in the LF04 upper zone flow system, the following monitor wells were installed:

1. Wells HM-5 and HM-9 (installed during Phase I investigation activities), and
2. Well HM-101 (installed during IRP, Phase II investigation activities).

FIG317



KEYMAP

LANDFILL No.4

LANDFILL No.4

LANDFILL No.2

FORMER
FUEL STORAGE
AREA

SW-3
SW-2
SB-005
HM-33
HM-9
SB-003
SB-004
HM-5
SB-002
SB-001
HM-101
HM-42
HM-2
HM-102
HM-41
P-21U
P-25M
P-25U
HM-46
HM-43
HM-40
P-20M
HM-30
HM-44
W-154/SB-141
HM-22
HM-100
SB-074
HM-8
HM-32
EPA-4

N

0 100 200
SCALE FEET

Figure 3.1-8
SAMPLE LOCATION MAP - LANDFILL NUMBER 4

SOURCE: ESE, CN GEOTECH

Environmental
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Engineering, Inc.
A CELCORP Company

One monitor well was installed to determine the groundwater quality in the Paluxy aquifer. Well P-20m was installed during the IRP Phase II investigation. Lithologic logs for the monitor wells are included in Appendix C. Groundwater samples collected from LF04 contained undetectable concentrations of contaminants.

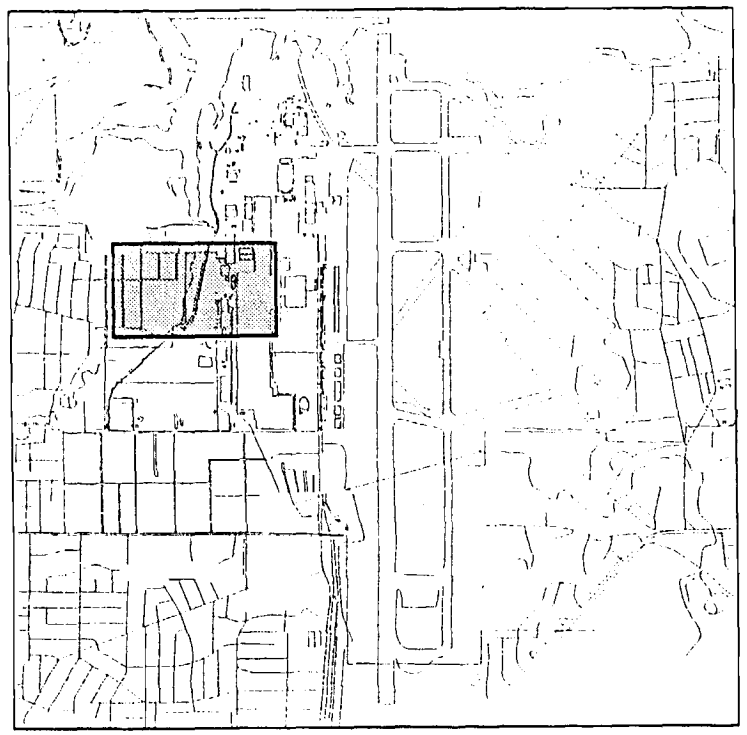
Although a no-further action was recommended for the site, there were insufficient data to support this decision. Five soil borings (Borings SB-001 through SB-005) were drilled in LF04 during the PA/SI/RI. Soil samples collected from Borings SB-001 and SB-003 contained numerous VOCs and SVOCs, including TCE. High concentrations of metals were detected in Boring SB-001.

The heterogenous composition of LF04 makes characterization of contamination difficult. Significant concentrations of chemicals of potential concern (COCs) have been detected in Borings SB-001, SB-002, and SB-003, proving that LF04 was used for the disposal of waste other than construction debris. Although groundwater contamination was not detected, the estimated volume of VOC and SVOC contamination is approximately 32,000 yd^3; 5,300 yd^3 of this volume are contaminated with metals (Geotech, 1992).

3.1.5 FDTA 2

FDTA 2 was a 50-ft-diameter earthen ring located north of LF01 in the west parking lot (Figure 3.1-9). This location was used for fire training exercises from 1955 to 1956. Exercises were held twice a year with approximately 250 gal of waste oil and fuels used for each exercise. It was suspected that disposal of oils and fuels, and uncontrolled burns may have been more frequent. The site has been graded and paved to provide a parking lot.

FIG319



KEYMAP

Figure 3.1-9
SITE MAP – FIRE DEPARTMENT TRAINING AREA NUMBER 2

SOURCE: ESE; ON GEOTECH

Environmental Science & Engineering, Inc.
A CELCORP Company

Both soil and groundwater analyses indicate that fuel related contamination is present at FDTA 2. Groundwater collected from the center of FDTA 2 contained contaminants that indicate the presence of solvent-related free product.

Subsurface assessment activities were conducted to determine the extent of contamination present in soils and groundwater at FDTA 2. Five soil borings and five monitor wells were installed, and a terrain conductivity study was conducted at FDTA 2 during the following studies:

1. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, Inc., September 1985 (01013);
2. Ten-Site Field Investigation Plant 4, Intellus Corporation, November 1987;
3. IRP Phase II Confirmation/Quantification Stage I, Radian Corporation, December 1987 (01041); and
4. Preliminary Assessment/Site Inspection and Remedial Investigation, Geotech, December 1992 (X07).

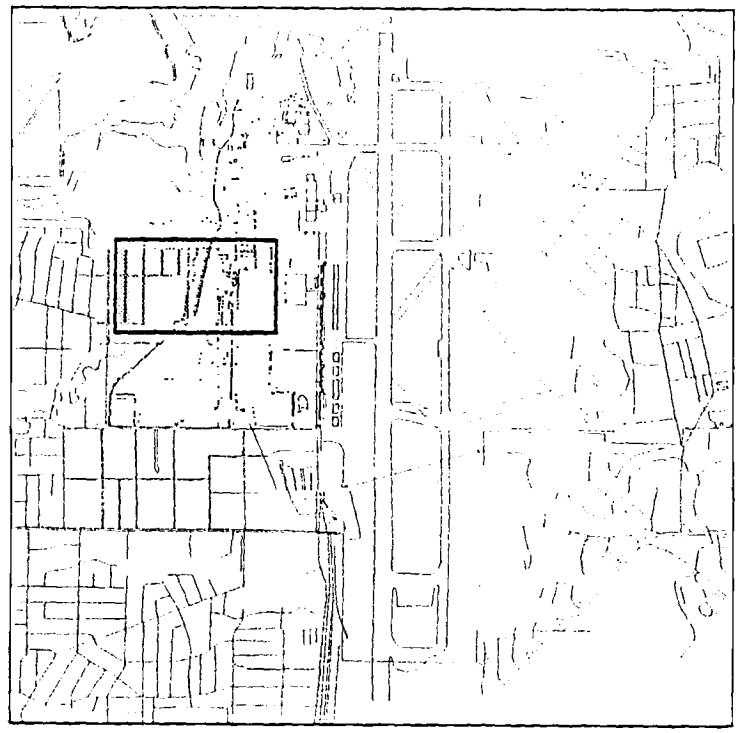
Summaries for each of these reports are included in Appendix A. Reports containing site-specific information concerning FDTA 2 are listed in Table 3.1-1.

To determine the hydrogeologic properties and groundwater quality of the upper zone flow system in the FDTA 2 area, the following five upper zone monitor wells were installed:

1. Wells HM-49, HM-51, HM-65, and HM-66 (installed during Phase II Investigation activities), and
2. Well F-213 (installed during Ten-Site Field Investigation activities).

Soil boring and monitor well locations are shown on Figure 3.1-10. Lithologic logs for the monitor wells are included in Appendix C. Additionally, a terrain conductivity study was completed during IRP Phase II activities. The terrain

FIG319



KEYMAP

Figure 3.1-10
SAMPLE LOCATION MAP – FIRE DEPARTMENT TRAINING AREA NUMBER 2

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A GILCORP Company

conductivity study was performed during the IRP Phase II investigation to determine the extent of a petroleum hydrocarbon plume at FDTA 2.

Soil and groundwater samples collected during remedial assessment activities indicate contamination by fuel-related hydrocarbon, VOCs, SVOCs, and metals. Results of the terrain conductivity study reflect an anomaly in the general site area that is interpreted to reflect shallow soil contamination. The estimated amount of contaminated soils is 1,350 yd^3.

Approximately 5,700 yd^3 of soils were excavated and treated through an onsite biological treatment system. Soil excavation was initiated in May 1993, and soil treatment was initiated in June 1993 and is near completion. Hazardous materials which were not planned to be removed during treatment require further action. A risk assessment will be performed to determine if soils warrant further remediation. No schedule for the risk assessment was available.

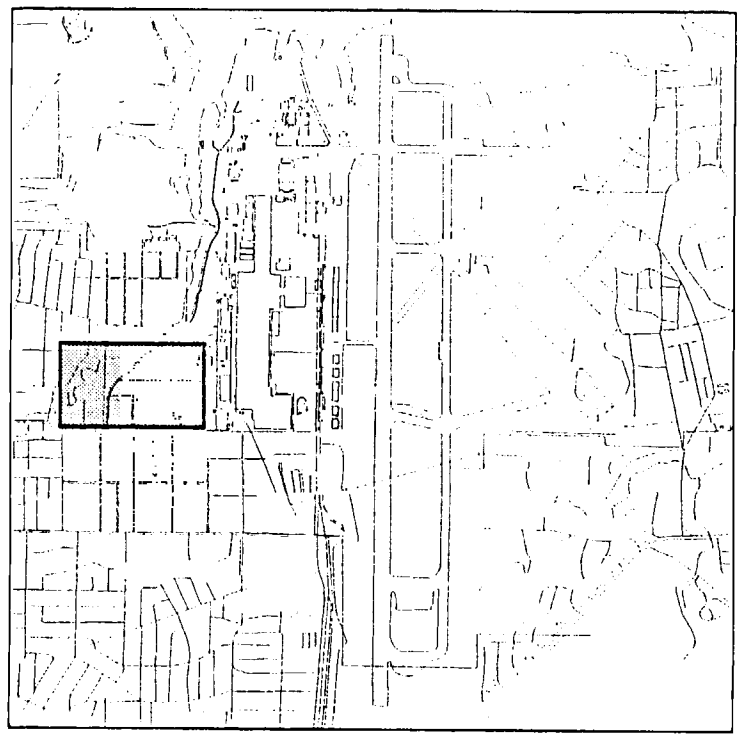
3.1.6 FDTA 3

Training exercises at FDTA 3 used approximately 250 gal of waste fuel and oils per exercise. The location and current condition of FDTA 3 could not be accurately determined because it is not visible on historical aerial photographs. The approximate location of FDTA 3 as estimated by Radian (1987), is shown on Figure 3.1-11.

To determine groundwater quality in the upper zone flow system, two monitor wells were installed in the approximate location of FDTA 3 during the following studies:

1. Phase II Investigation of Subsurface Conditions, Hargis & Associates, Inc., September 1985 (1013); and
2. IRP Phase II, Confirmation/Quantification Stage I, Radian Corporation, December 1987 (1041).

FIG3111



KEYMAP

LANDFILL No.4

FDTA No.3

LANDFILL No.2

FORMER
FUEL STORAGE
AREA

N

0 100 200
SCALE FEET

Figure 3.1-11
SITE MAP - FIRE DEPARTMENT TRAINING AREA NUMBER 3

SOURCE: ESE, CN GEOTECH

Environmental
Science &
Engineering, Inc.

Well HM-33, the first monitor well, was installed in the center of FDTA 3 during Phase II investigation activities. Well HM-102 was installed during the IRP Phase II Conformation/Quantification study. Well HM-102 was installed east of FDTA 3 (Figure 3.1-12). Lithologic logs for Wells HM-33 and HM-102 are included in Appendix C.

Soil and groundwater samples collected from FDTA 3 contained detectable amounts of VOCs which do not exceed MCL criteria. It was recommended during the IRP Phase II study that no further IRP actions be conducted at FDTA 3.

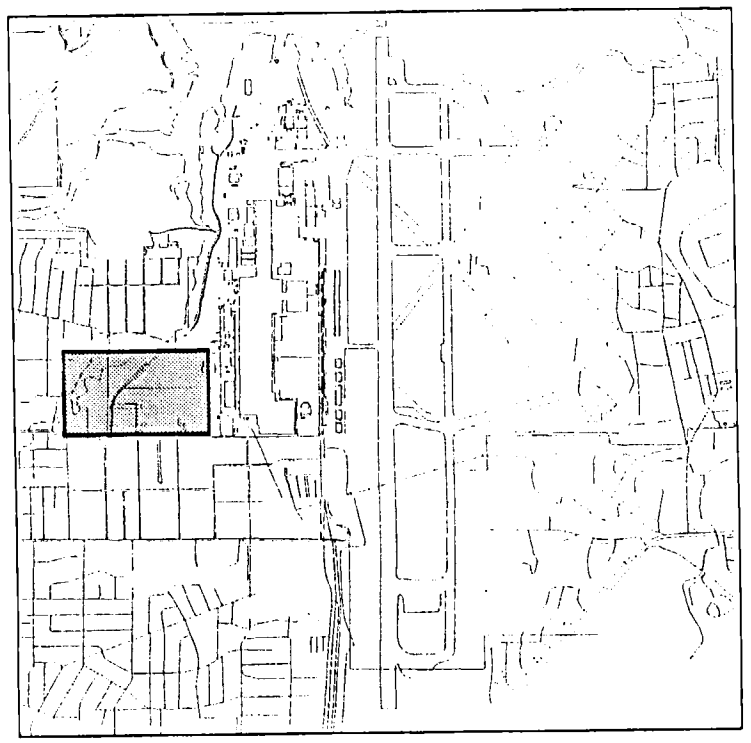
3.1.7 FDTA 4

Training exercises at FDTA 4 were the same as those conducted at FDTA 3. This site is not visible on historical aerial photographs; therefore, its previous and current locations are not accurately known. The area is also believed to have received fill material originating from a foundation excavation at the administration building. The estimated location of FDTA 4 is shown on Figure 3.1-13.

To determine the location of FDTA 4 and to delineate the extent of soil contamination, a soil gas survey was conducted in the estimated area of FDTA 4 during the IRP Phase II study (Radian, 1987). Survey locations are presented in Figure 3.1-14. Samples collected during the soil gas survey contained undetectable amounts of hydrocarbons. After the soil gas survey was conducted, fire department personnel were requested to pinpoint the FDTA 4 location reported during the IRP Phase I report. AFP4 fire department personnel reported that an FDTA never existed in this area. It was recommended in the IRP Phase II study that no further IRP action be taken at FDTA 4. No further action status was achieved at FDTA 4.

FIG3111

183112



KEYMAP

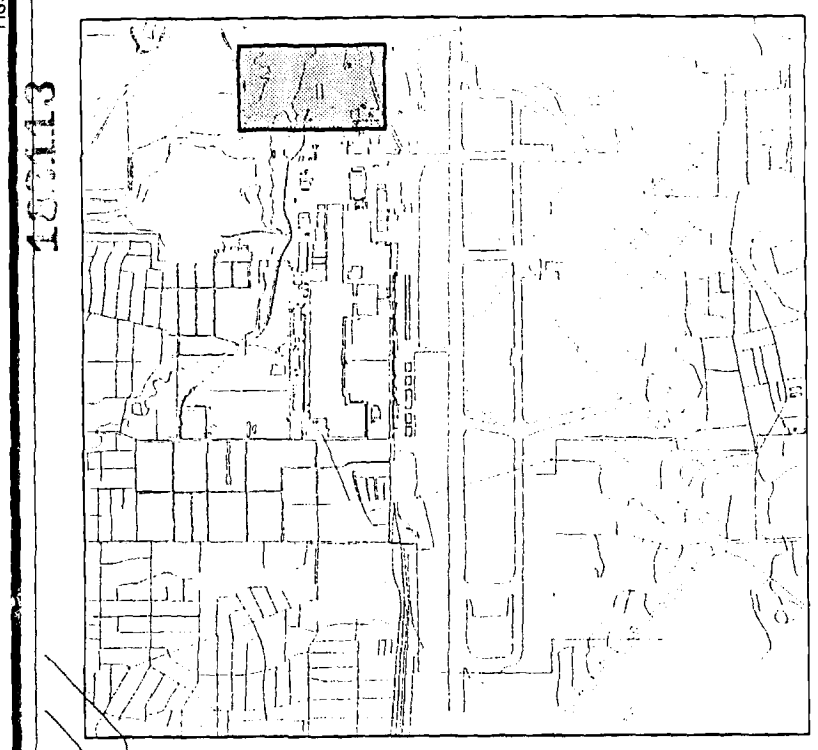
SW-3
P-25M
P-25U
HM-46
HM-2
HM-102
HM-41
SB-005
HM-33
FDTA No.3
P-21U
HM-9
SB-004
SW-2
SB-003
HM-101
HM-42
HM-5
LANDFILL No.4
SB-002
SB-001
HM-43
LANDFILL No.2
HM-40
P-20M
HM-30
HM-44
W-154/SB-141
HM-22
HM-100
SB-074
HM-8
HM-32
EPA-4
FORMER
FUEL STORAGE
AREA
N
0 100 200
SCALE FEET

Figure 3.1-12
SAMPLE LOCATION MAP – FIRE DEPARTMENT TRAINING AREA NUMBER 3

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

FIG3113



KEYMAP

Figure 3.1-13
SITE MAP - FIRE DEPARTMENT TRAINING AREA NUMBER 4

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CH2MHILL Company

FIG3113

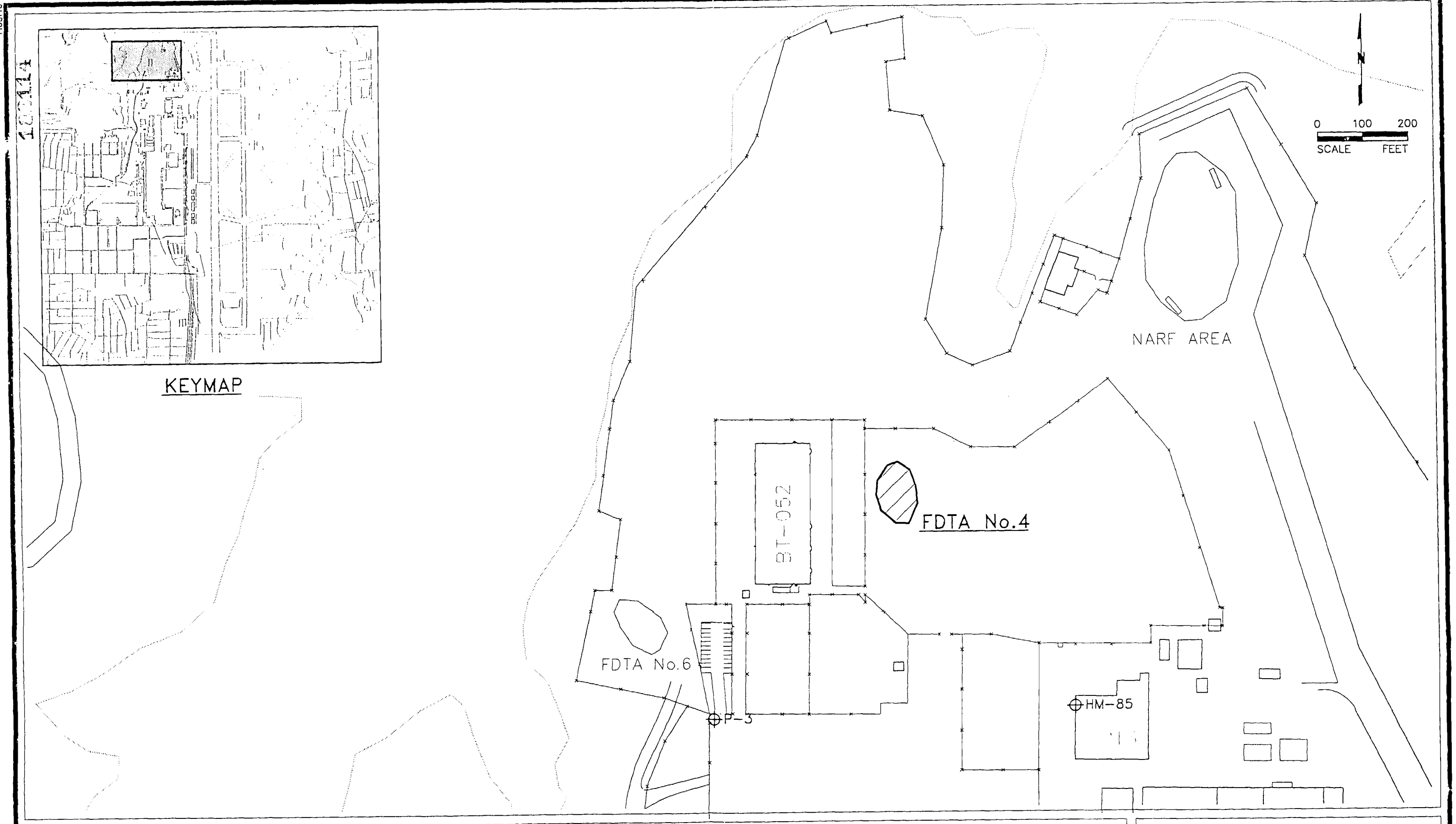


Figure 3.1-14
SAMPLE LOCATION MAP - FIRE DEPARTMENT TRAINING AREA NUMBER 4

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

3.1.8 FDTA 5

FDTA 5, located south of Facilities Building No. 12 (Figure 3.1-15), consisted of a shallow pit approximately 35 ft wide by 45 ft long that received waste fuels, oils, and unspecified chemicals which were burned for fire extinguisher training exercises during the mid-1960s.

To determine the extent of contamination existing in soils and groundwater samples at FDTA 5, three soil borings and five upper zone monitor wells were installed during the following studies:

1. Phase I Investigation of Subsurface Conditions, Hargis & Montgomery, December 1983 (01002);
2. Phase II Investigation of Subsurface Conditions, Hargis & Associates, Inc., September 1985 (01013);
3. Ten-Site Field Investigation, Intellus Corporation, November 1987;
4. IRP Phase II Confirmation/Quantification Stage I, Radian Corporation, 1987? (01041); and
5. Preliminary Assessment/Site Inspection and Remedial Investigation, Geotech, December 1992 (X07).

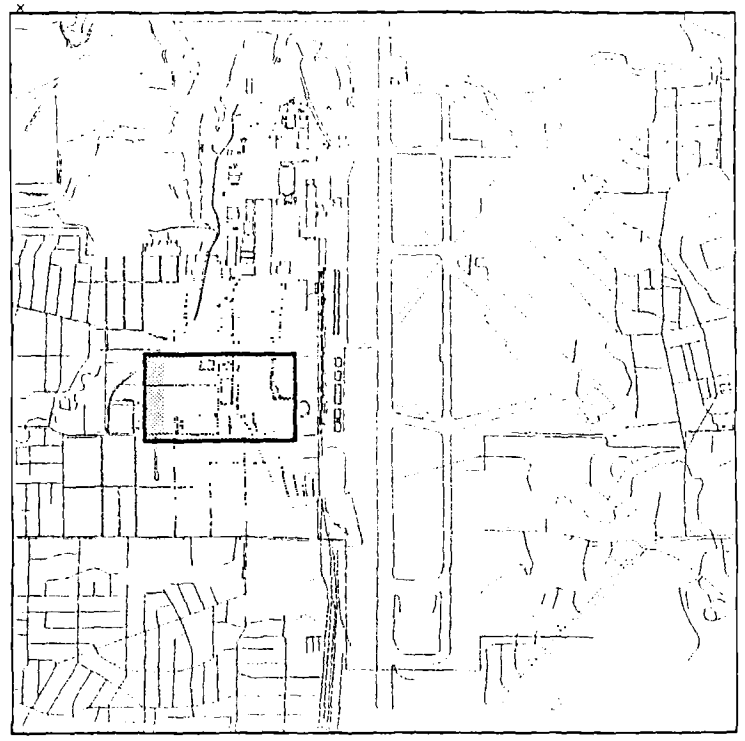
Summaries of these reports are included in Appendix A. Reports containing specific information pertaining to FDTA 5 are indicated in Table 3.1-1.

To determine the hydrogeologic properties and groundwater quality of the upper flow zone in the FDTA 5 area, the following monitor wells were installed:

1. Well HM-25 (installed during Phase I investigation activities);
2. Well F-221 (Ten-Site Field Investigation activities); and
3. Wells W-131U, W-133U, and W-133L (Remedial Investigation activities).

Monitor well and soil boring locations are shown on Figure 3.1-16. Lithologic logs for the monitor wells are included in Appendix C.

FIG3115



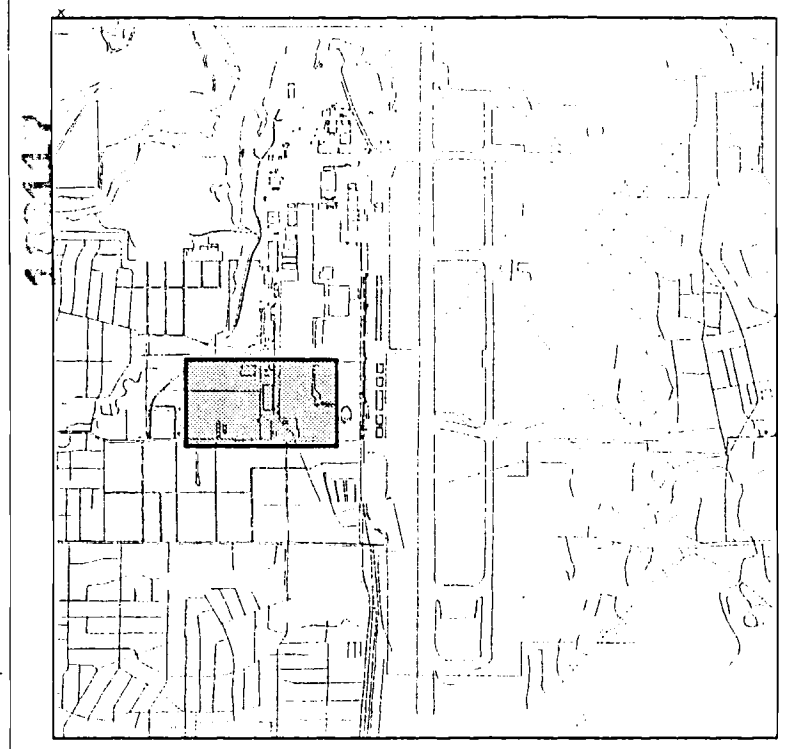
KEYMAP

Figure 3.1–15
SITE MAP – FIRE DEPARTMENT TRAINING AREA NUMBER 5

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

FIG3115



KEYMAP

HM-100
SB-074
HM-8
HM-32
HM-14
HM-13
HM-12
P-34U
HM-45
W-145
HM-16
W-150L/SB-134
W-150U
F-220
HM-30
HM-1
HM-17
W-154/SB-141
CHROME PIT No.5
HM-15
HM-52
SB-046
HM-48
SB-047
SB-048
HM-60
HM-11
P-1
P-26U
P-26M
SB-055
HM-88
SB-054
F-219
F-218
W-158/SB-152
W-159/SB-153
CHROME PIT No.1
HM-70
HM-103
SB-053
HM-104
HM-31
P-12US
P-12UN
P-12M
SB-052
HM-69
P-30M
SB-045
0 100 200
SCALE FEET
FORMER FUEL STORAGE AREA
DIE YARD CHEMICAL PITS
P-2
HM-28
SB-009
SB-057
HM-77
SB-049
W-137/SB-110
HM-47
WASTEWATER COLLECTION BASINS
W-160/SB-154
SB-011
HM-3B
SB-058
SB-066
W-133L/SB-078
HM-3A
SB-067
W-133U/SB-067
SB-007
HM-24
SB-010
HM-4A
SB-059
HM-4B
F-221
SB-006
SB-064
FDTA No.5
S-157/SB-151
FDTA No.5
CHROME PIT No.2

Figure 3.1-16
SAMPLE LOCATION MAP - FIRE DEPARTMENT TRAINING AREA NUMBER 5

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

Previous analytical results of soil samples collected from two soil borings within the pit area indicated that shallow soils did not contain significant concentrations of contaminants. Groundwater samples collected contained anomalous concentrations of VOCs, SVOCs, and fuel hydrocarbons. Fuel-related product was observed in monitor wells in the vicinity of FDTA 5. Arsenic was also detected in monitor wells at FDTA 5 in concentrations exceeding drinking water standards. The estimated volume of soil contamination is 900 yd^3 (Geotech, 1992).

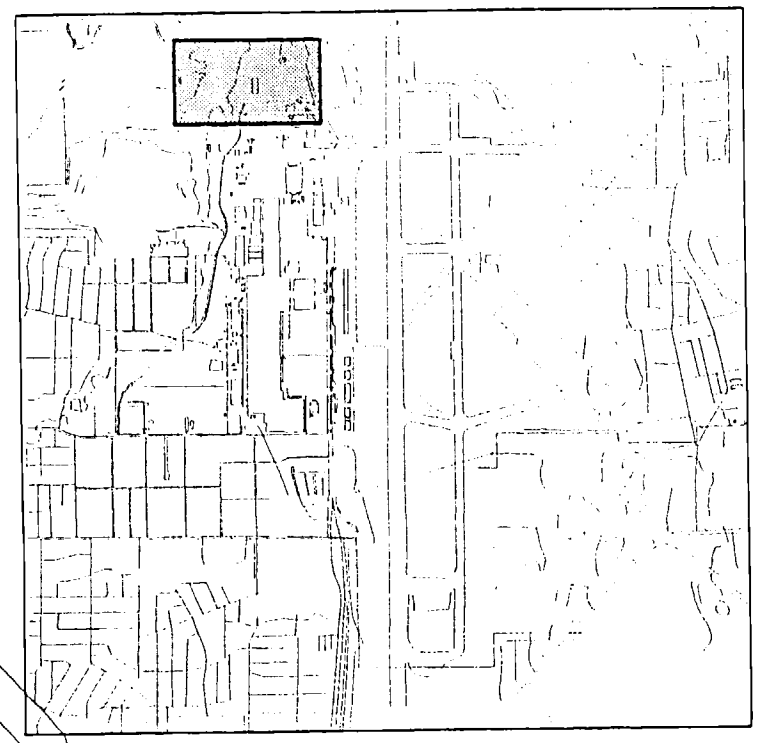
3.1.9 FDTA 6

FDTA 6 was the primary training area at AFP4. It was located on the northwest side of AFP4 adjacent to the Meandering Road Creek and Lake Worth. The site location is presented in Figure 3.1-17. FDTA 6 consisted of a 50-ft-diameter, gravel-lined ring that was approximately 2 ft deep surrounded by an earthen berm. FDTA 6 was used from the late 1950s to 1980 for periodic training exercises that used approximately 250 gal of waste oil and fuels per exercise. Before 1970, training exercises were conducted twice a year; after 1970, the exercises were conducted monthly. The IRP Phase I investigation indicated that unknown quantities of fuels and oils were likely deposited in FDTA 6 between training exercises. Analytical results from previous investigations indicated that the soils at FDTA 6 are contaminated with VOCs, SVOCs, fuel hydrocarbons, and oil and grease. No groundwater samples were collected in the immediate area of FDTA 6 because no upper zone groundwater exists in the area. Bedrock in the FDTA 6 area is approximately 3 ft below the surface.

Subsurface assessment activities were conducted to determine the extent of contamination existing in the soil and groundwater at FDTA 6. One Paluxy monitor well (Well P-3) and 15 soil borings were installed to during the following investigations:

1. Phase I, Investigation of Subsurface Condition, Hargis & Montgomery, February 1983 (Installation of P-3) (1002);

FIG3117



KEYMAP

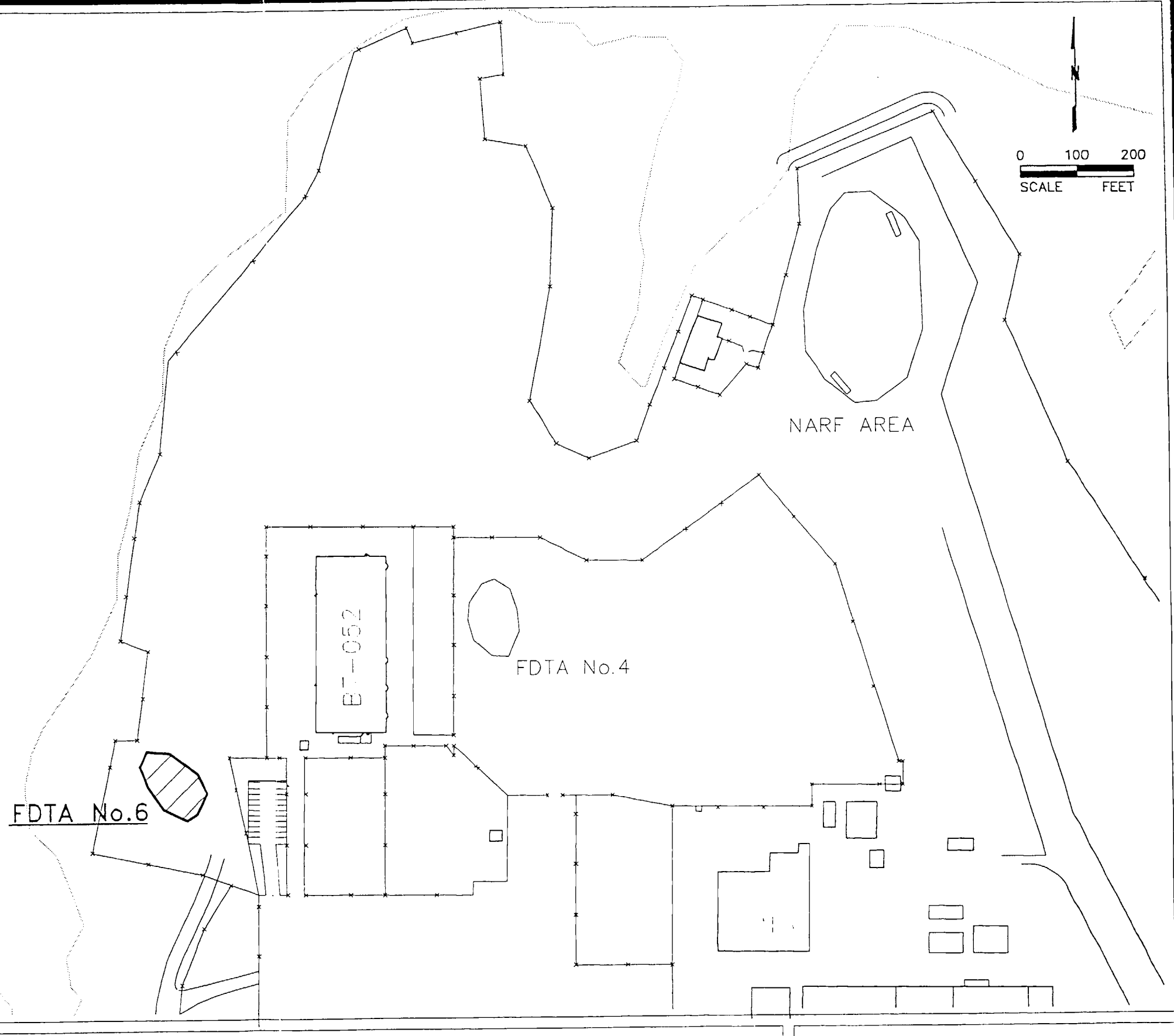


Figure 3.1–17
SITE MAP – FIRE DEPARTMENT TRAINING AREA NUMBER 6

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

2. Ten-Site Field Investigation, Intellus Corporation, November 1986 (1026);
3. IRP Phase II Confirmation/Quantification Stage I, Radian Corporation, December 1987 (1041); and
4. Preliminary Assessment/Site Investigation and Remedial Investigation, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. The Well P-3 lithologic log is included in Appendix C. Reports containing site-specific information concerning FDTA 6 are listed in Table 3.1-1.

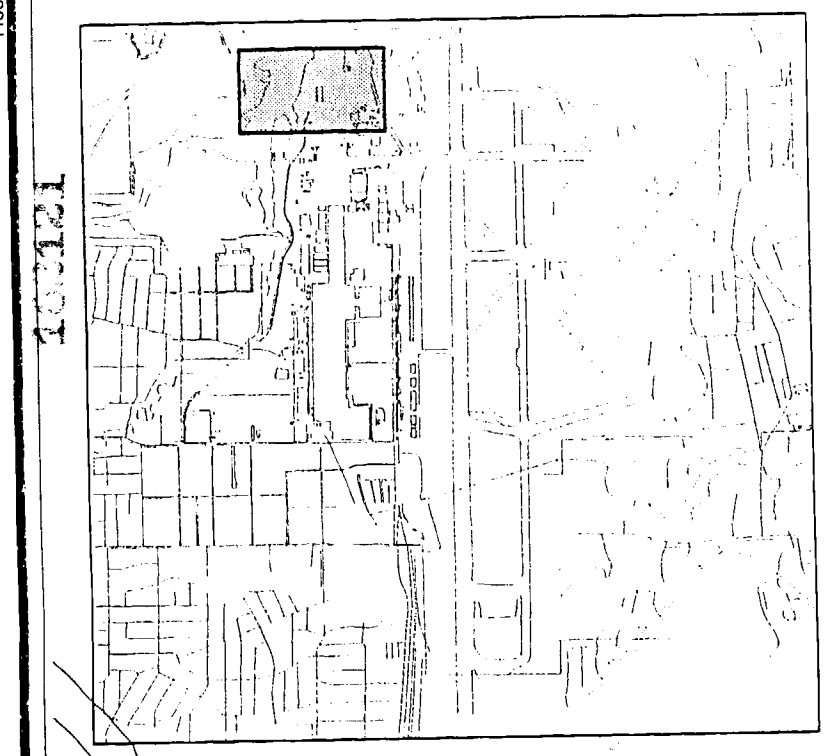
In 1982, Hargis & Montgomery collected soil samples from test hole TH-26, which was drilled to a depth of 6 ft in the fire-training burn pit (Figure 3.1-18). The sample from 2 to 3 ft was submitted for chemical analysis. Methylene chloride (217 μg/kg), di-n-butyl phthalate (170 μg/kg), and oil and grease (0.379 mg/kg) were detected in soils from TH-26.

Interim remedial action was performed at FDTA 6 in 1982 and 1983 when oil-and-fuel contaminated soils were removed and hauled to an approved hazardous waste landfill. Although most of the contamination may have been removed, there were insufficient data to verify that remaining contaminants did not pose a potential risk to the environment or human health.

In 1986, Intellus Corporation drilled test borings (Borings FB-1, FB-2, and FB-3) (Figure 3.1-18) at the reported location of FDTA 6. Laboratory analysis of the soil samples failed to identify any contaminants. As shown on Figure 3.1-18, these borings may not have been properly located.

The IRP Phase II investigation was performed by Radian Corporation in 1985 and 1986. Activities included hand augering and collection of soil samples from six boreholes in May 1986, ranging from 6 to 18 inches deep: HA-1, HA-2,

FIG3117



KEYMAP

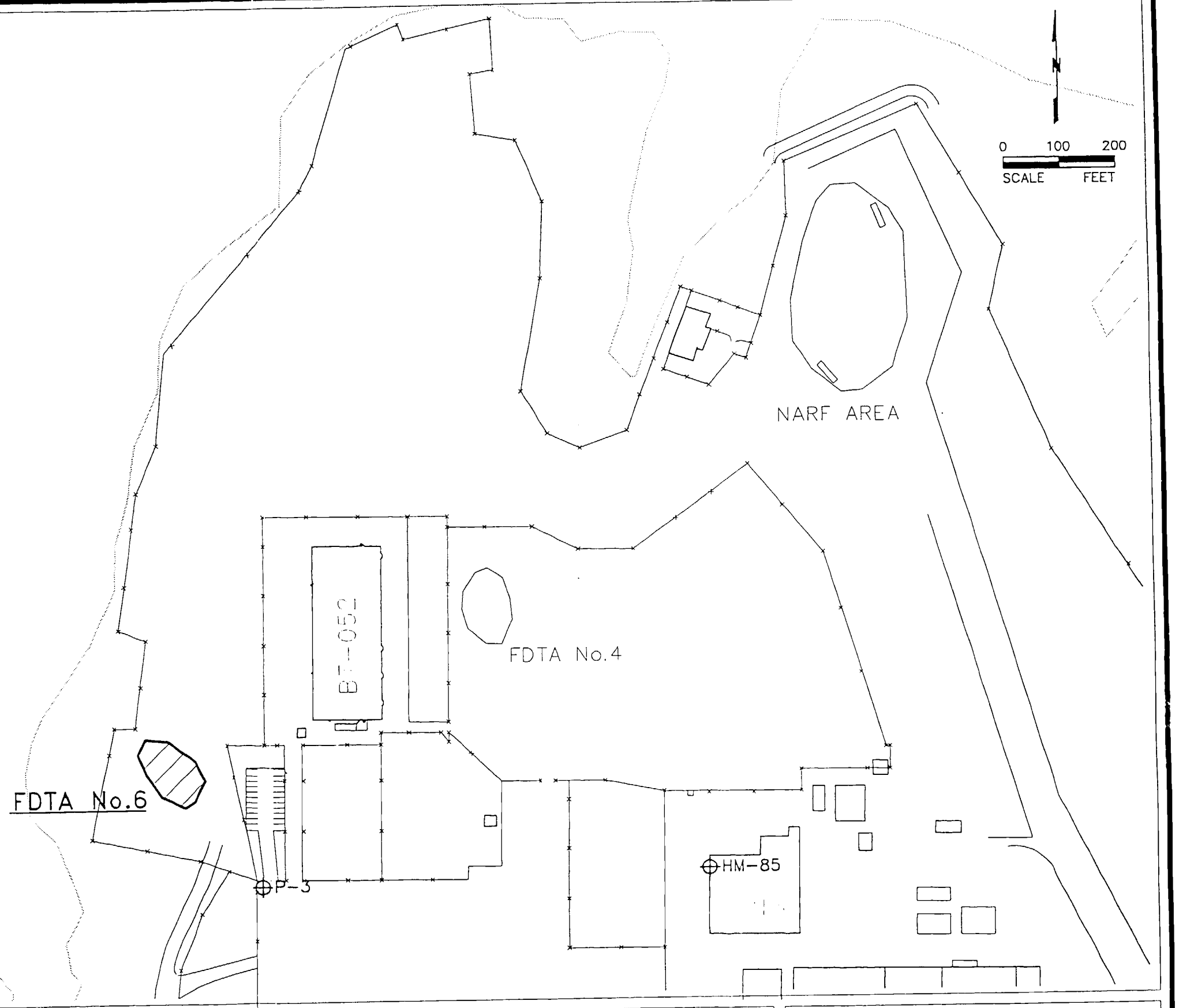


Figure 3.1-18
SAMPLE LOCATION MAP - FIRE DEPARTMENT TRAINING AREA NUMBER 6

SOURCE: ESE; CN GEOTECH

ESE
A CALCORP Company
Environmental Science & Engineering, Inc.

HA-3, HA-4, HA-5, and HA-6 (Figure 3.1-18). (Results of the analyses are presented in Radian 1987.) Five of six soil samples show evidence of residual contamination associated with past activities at FDTA 6. Significant concentrations of hydrocarbon fuels (14,000 mg/kg), oil and grease (13,000 mg/kg), TCE (21 μg/kg), naphthalene (2,300 μg/kg), and phenanthrene (8,300 μg/kg) were detected in the soil samples.

Analytical results of previous investigations indicate that the soils around FDTA 6 are contaminated with VOCs, SVOCs, fuel hydrocarbons, and oil and grease. Contaminants identified at FDTA 6 include fuel-related hydrocarbons, oil and grease, trichloroethane, naphthalene, and phenanthrene. Data from these investigations were evaluated; however, because the exact location of the borings was not known, the data were not used to define the extent of contamination. The three FB-series borings drilled by Intellus (Figure 3.1-18) were used to demonstrate that contamination was not spreading.

Soil samples collected from the five borings (Borings SB-094 through SB-098) performed during the PA/SI and RI indicated that the soils were contaminated with toluene and oil and grease. The soil sample collected from Boring SB-094 contained 11 μg/kg of toluene. Oil and grease was detected in four of the five soil borings with a maximum concentration of 2,300 mg/kg.

The previous interim remedial action and various earthmoving activities in the FDTA 6 area resulted in either removal or redistribution of contaminated soil. Relatively low levels and limited extent of toluene and oil and grease were found in two boreholes. Remediation of the site would require the removal of an estimated 170 yd^3 of contaminated material (Geotech, 1992).

3.1.10 CHROME PIT NO. 1

Miscellaneous liquid and solid chemical wastes and chrome wastes were probably deposited at Chrome Pit No. 1. The actual location of Chrome Pit No. 1 is

believed to be somewhere beneath the Process Building; however, the Phase I report could not accurately confirm the location. The approximate location, as estimated by Radian Corporation, is shown on Figure 3.1-19. Two monitor wells were installed to determine groundwater quality at this site.

Two upper zone monitor wells were installed during the following subsurface assessments:

1. Phase II Investigation of Subsurface Conditions at Plant No. 4, Hargis & Associates, Inc., September 1985 (01013); and
2. IRP Phase II Confirmation/Quantification Stage I, Radian Corporation, December 1987 (01041).

Detailed summaries of these reports are included in Appendix A. Reports containing specific information pertaining Chrome Pit No. 1 are indicated in Table 3.1-1.

The location of Wells HM-48 and HM-103 are shown on Figure 3.1-20. Lithologic logs for the monitor wells are included in Appendix C. Groundwater samples collected from Wells HM-48 and HM-103 contained concentrations of TCE exceeding MCL criteria. Soil samples collected during IRP Phase II field activities contained elevated levels of TCE. Chromium was detected in soil samples at established background levels. Reports containing specific information pertaining to Chrome Pit No. 1 are listed in Table 3.1-1. It was recommended during the IRP Phase II study that Chrome Pit No. 1 should be released for Phase IV remedial action planning (Radian, 1985). A no further action status was granted to Chrome Pit No. 1.

3.1.11 CHROME PIT NO. 2

According to the Phase I study, miscellaneous liquid and solid wastes and chromate solutions were probably disposed of at Chrome Pit No. 2. Neither aerial photographs nor interviews could confirm the exact location of Chrome Pit

FIG3119

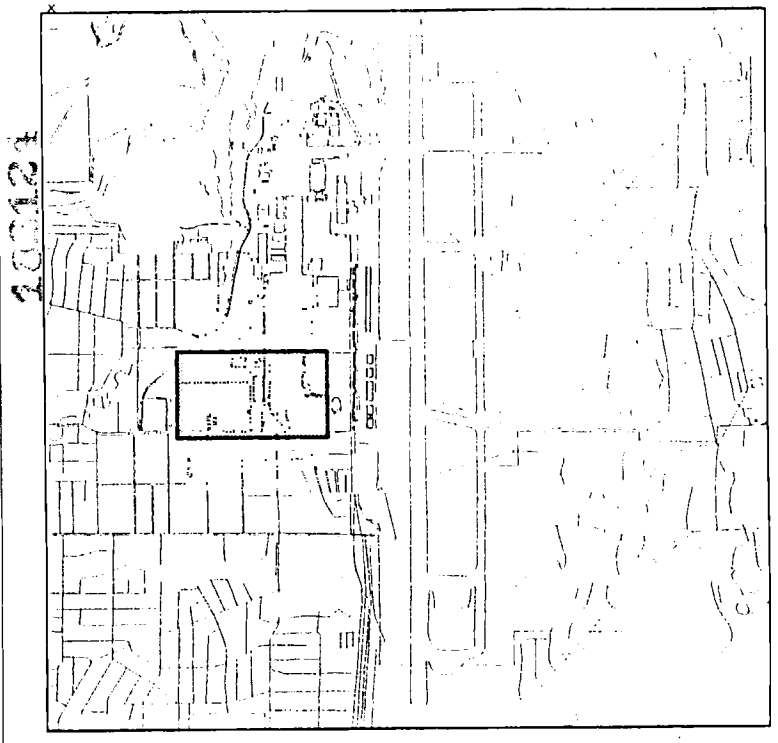


Figure 3.1-19
SITE MAP - CHROME PIT NUMBER 1

SOURCE: ESE, CN GEOTECH

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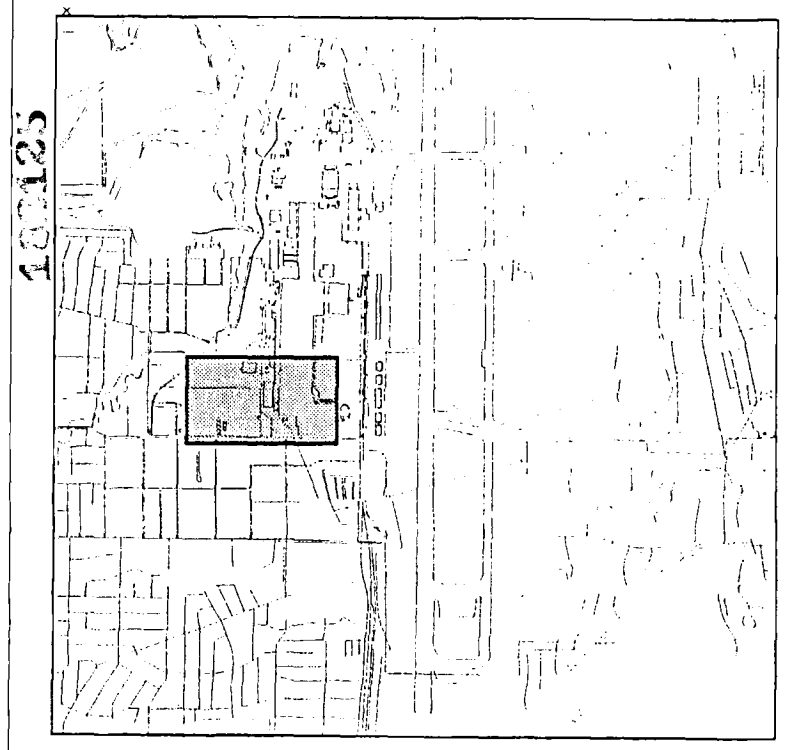
FIG3119



KEYMAP

HM-45
HM-52
SB-055
HM-88
W-145
SB-054
F-219
0 100 200
SCALE FEET
HM-16
W-150L/SB-134
W-150U
F-220
HM-30
HM-1
HM-17
SB-046
HM-48
SB-047
F-218
W-154/SB-141
CHROME PIT No.3
W-158/SB-152
W-159/SB-153
HM-103
HM-70
SB-053
HM-15
CHROME PIT No.1
SB-048
HM-60
HM-100
SB-074
HM-8
HM-32
CHROME PIT No.2
HM-28
SB-009
SB-049
SB-057
HM-77
P-2
W-137/SB-110
HM-47
W-160/SB-154
DIE YARD CHEMICAL PITS
SB-011
SB-066
SB-058
W-133L/SB-078
HM-69
HM-3B
HM-3A
SB-007
SB-067
W-133U/SB-067
HM-24
SB-010
SB-065
HM-4A
SB-059
SB-064
HM-4B
F-221
SB-006
SB-052
FORMER FUEL STORAGE AREA
HM-14
HM-13
HM-12
P-34U
HM-11
P-16
P-26M
P-26U
HM-104
HM-31
P-12US
P-12UN
P-12M
P-30M
SB-045
S-157/SB-151
FDTA No.5

Figure 3.1-20
SAMPLE LOCATION MAP - CHROME PIT NUMBER 1

SOURCE: ESE, CN GEOTECH

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No. 2; the estimated location of Chrome Pit No. 2 is shown on Figure 3.1-21. One monitor well was installed to determine the groundwater quality in the upper zone flow system at the site. Well HM-77, completed during the Phase II Investigation of Subsurface Conditions (Hargis & Associates, Inc., 1985), is located directly west of the estimated location of Chrome Pit No. 2 (Figure 3.1-21). A summary of the Phase II investigation is included in Appendix A. A lithologic log for Well HM-77 is included in Appendix C. Reports containing specific information on Chrome Pit No. 2 are listed in Table 3.1-1.

During IRP Phase II activities, a groundwater sample was collected from Well HM-77. The study area location is shown in Figure 3.1-22. The groundwater sample contained negligible amounts of VOCs and metals. It was recommended during the IRP Phase II study that this site be released for Phase IV remedial action planning (Radian, 1985). A no further action status was granted to Chrome Pit No. 2.

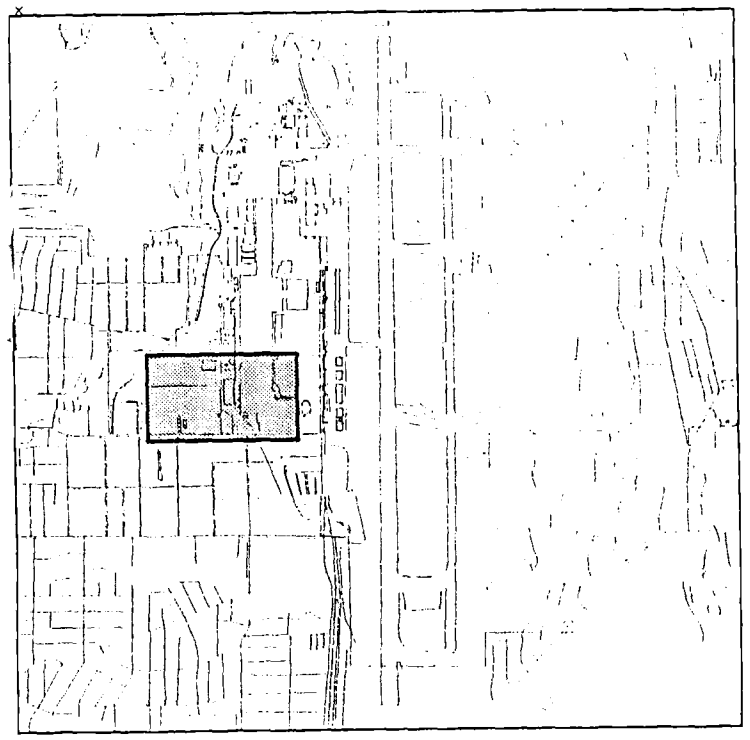
3.1.12 CHROME PIT NO. 3 (DP12)

DP12, located on the radar range west of Facilities Building No. 12 (Figure 3.1-23), was used for the disposal of chromate sludge, barium-chromate sludge, dilute metal solutions, and drums of unidentified liquids from 1953 to 1973. DP12 measures 65 ft by 165 ft long by 22 ft deep.

From December 1983 through January 1984, approximately 8,900 yd^3 of contaminated soil were excavated and removed from DP12 as an interim remedial action. Analytical results of samples collected during the excavation indicates that the greatest concentrations of contaminants were removed. However, some contaminants may have remained in the soils and groundwater adjacent to the excavated portion of DP12.

Subsurface exploration activities at DP12 included the installation of monitor wells and soil borings during the following remedial assessment studies:

FIG3119



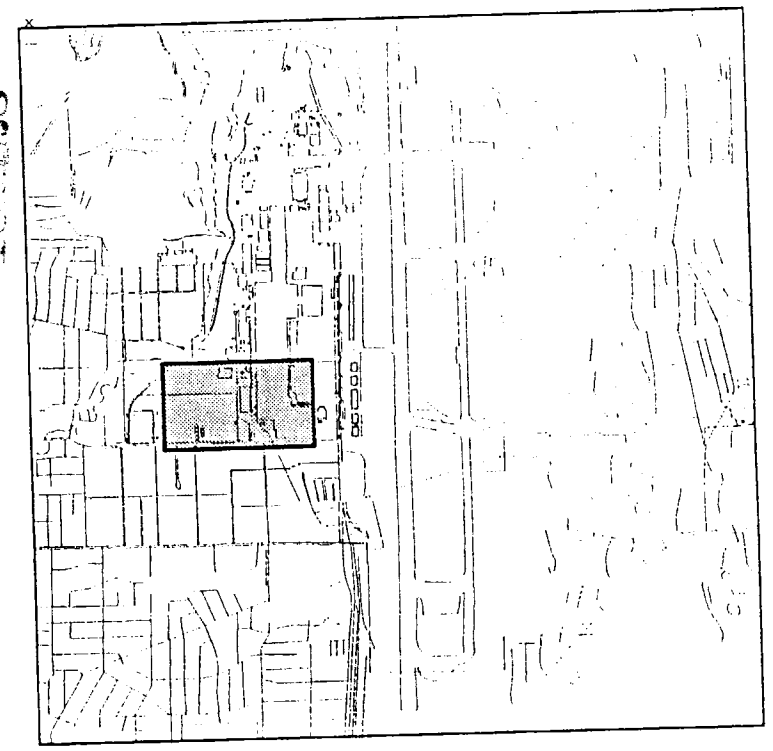
KEYMAP

Figure 3.1-21
SITE MAP - CHROME PIT NUMBER 2

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

FIG3119



KEYMAP

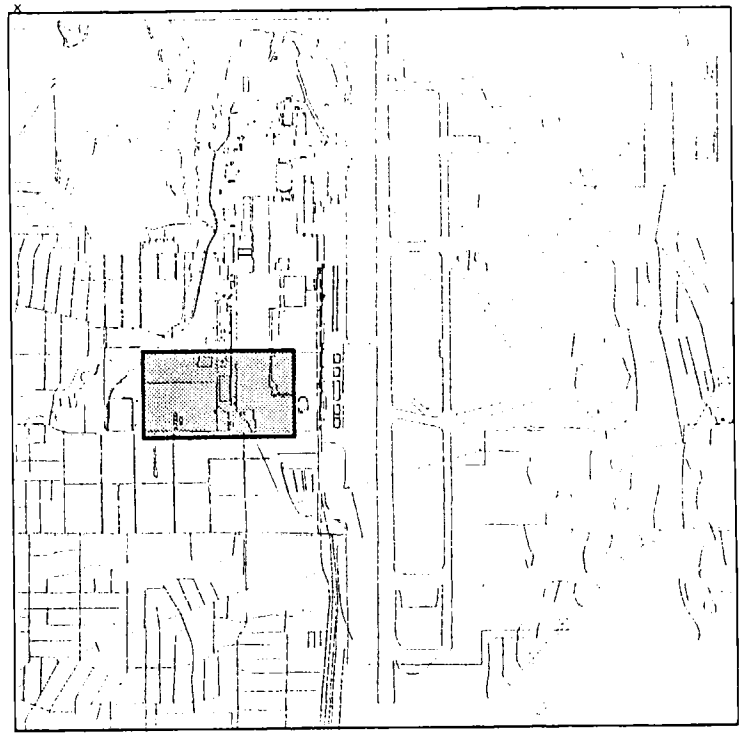
HM-45
HM-52
SB-055
HM-88
W-145
SB-054
F-219
0 100 200
SCALE FEET
HM-16
SB-046
W-150L/SB-134
W-150U
HM-48
F-220
SB-047
F-218
HM-30
HM-1
HM-17
W-158/SB-152
W-159/SB-153
W-154/SB-141
CHROME PIT No.3
CHROME PIT No.1
HM-103
HM-70
SB-053
HM-15
SB-048
HM-60
HM-100
SB-074
HM-8
HM-32
HM-28
SB-009
SB-049
CHROME PIT No.2
P-2
SB-057
HM-77
W-137/SB-110
W-160/SB-154
HM-47
HM-69
DIE YARD
CHEMICAL PITS
SB-011
SB-066
HM-3B
SB-058
W-133L/SB-078
HM-3A
SB-067
W-133U/SB-067
SB-007
HM-24
SB-010
W-25
SB-065
HM-4A
SB-059
SB-064
HM-4E
F-221
SB-006
SB-052
P-26M
HM-104
P-12UN
HM-11
P-1
P-26U
HM-31
P-12US
P-12M
HM-14
HM-13
HM-12
P-31U
P-30M
SB-045
FORMER
FUEL STORAGE
AREA
S-157/SB-151
FDTA No.5

Figure 3.1-22
SAMPLE LOCATION MAP - CHROME PIT NUMBER 2

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A CALCORP Company

FIG3123



KEYMAP

CHROME PIT No.3

12

CHROME PIT No.1

181

CHROME
PIT No.2

0 100 200
SCALE FEET

FORMER
FUEL STORAGE
AREA

DIE YARD
CHEMICAL PITS

WASTEWATER
COLLECTION
BASINS

FDTA No.5

Figure 3.1–23
SITE MAP – CHROME PIT NUMBER 3

SOURCE: ESE, CN GEOTECH

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Engineering, Inc.

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1. Phase I Investigation of Subsurface Conditions at Plant No. 4, Hargis & Montgomery, February 1983 (1002);
2. Phase II Investigation of Subsurface Conditions at Plant No. 4, Hargis & Associates, Inc., September 1985 (1013);
3. Ten-Site Investigation Plant 4, Intellus Corporation, November 1986 (1026); and
4. Preliminary Assessment/Site Investigation and Remedial Investigation, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. Reports containing specific information pertaining to DP12 are listed in Table 3.1-1.

To determine the extent of soil and/or groundwater contamination at DP12, 13 monitor wells and 8 soil borings were installed (Figure 3.1-24). Monitor wells installed to characterize the groundwater contamination present and determine hydrogeologic properties of the upper zone flow system in DP12 include:

1. Well HM-1 (installed during Phase I investigation activities);
2. Wells HM-15, HM-16, HM-17, HM-30, HM-32, HM-41, and HM-45 (installed during Phase II investigation activities);
3. Well F-222 (installed during Ten-Site Investigation activities); and
4. Wells W-150U, W-150L, and W-154 (installed during PA/SI and RI activities).

To determine the quality of groundwater in the Paluxy Formation, one Paluxy monitor well (Well P-2) was installed during Phase II activities. Groundwater samples were collected during numerous water quality quarterly monitoring activities. Reports containing specific information concerning DP12 are listed in Table 3.1-1.

Soil and groundwater samples collected at this site contained concentrations of VOCs, primarily TCE, exceeding the MCL criteria. Concentrations of metals

FIG:1123

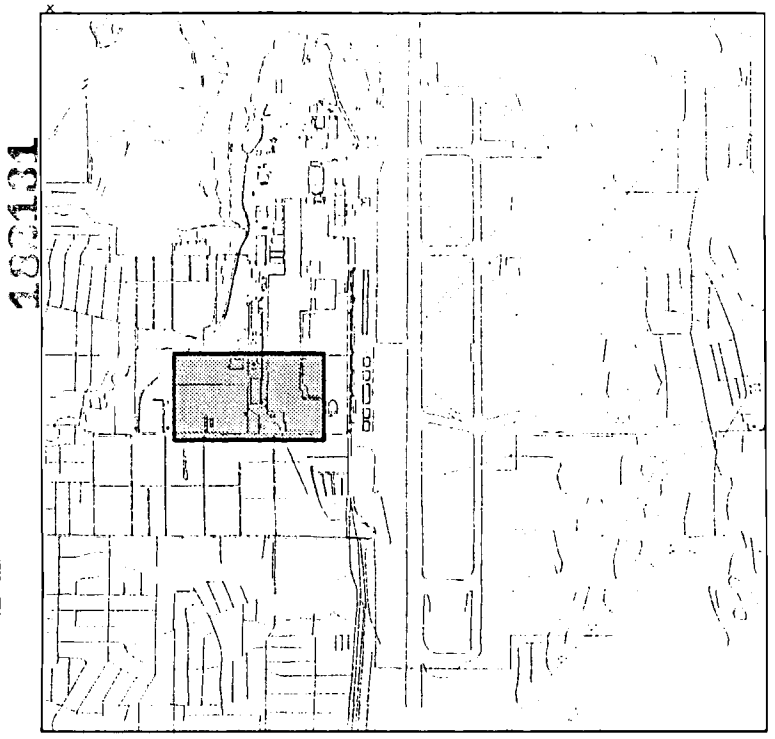


Figure 3.1-24
SAMPLE LOCATION MAP - CHROME PIT NUMBER 3

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CELCORP Company

detected in all soil and groundwater samples were below established background concentrations (Geotech, 1992). The interim remedial action (IRA) soils removal action is complete. The MAP projects the Proposed Plan will be completed in November 1993, and the final ROD will be due in June 1994.

3.1.13 DIE YARD CHEMICAL PIT (DP13)

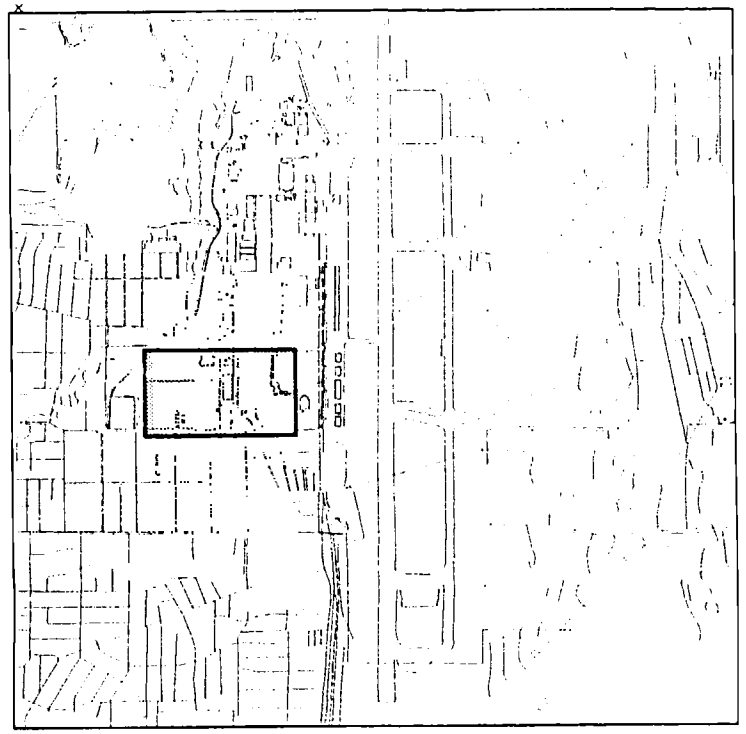
DP13 is located east of the radar range and south of Facilities Building No. 12 (Figure 3.1-25). Three pits with approximate dimensions of 20 ft wide by 90 ft long by 10 ft deep were constructed in 1956 and were used for the disposal of chromate sludges, metal solutions, and other chemical wastes. In 1962, DP13 was graded and paved for parking (Lot No. 9). On the basis of the IRP Phase I investigation, it is suspected that contaminated soils from DP13 may have been spread around the area during the grading activities. DP13 was excavated, and 1,100 yd^3 of contaminated soil were removed and transported to an approved hazardous waste landfill for disposal. Confirmation sampling was not performed to verify that the area was adequately remediated.

Subsurface assessment activities were conducted at DP13 to determine the extent and degree of contamination in the soils and groundwater. Twenty soil borings and eleven monitor wells were installed to assess subsurface conditions during the following studies:

1. Phase I Investigation, Drilling and Construction of Upper Zone Test Holes and Monitoring Wells, Hargis & Montgomery, January 1983 (1001);
2. Phase I Investigation of Subsurface Conditions at Plant 4, Hargis & Montgomery, 1983 (1002);
3. Phase II Investigation of Subsurface Contamination at Plant 4, Hargis & Associates, Inc., September 1985 (1013);
4. Ten-Site Field Investigation, Plant 4, Intellus Corporation, November 1986 (1026);

FIG3125

18133



KEYMAP

Figure 3.1–25
SITE MAP – DIE YARD CHEMICAL PIT

SOURCE: ESE; CN GEOTECH

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5. Construction Site Assessment for the Die Yard Zone, Intellus Corporation, January 1987 (1027); and
6. Remedial Investigation, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. Reports containing specific information about DP13 are included in Table 3.1-1.

To assess groundwater quality in the upper zone flow system, the following monitor wells were installed:

1. Wells HM-3a, HM-3b, HM-4a, and HM-4b (Phase I Investigation);
2. Wells HM-12, HM-24, HM-25, and HM-28 (Phase II Investigation);
3. Well F-221 (Ten-Site Field Investigation); and
4. Wells W-128U and W-128L (Remedial Investigation).

Monitor well and soil boring locations are shown on Figure 3.1-26. Wells HM-3a, HM-3b, HM-4a, and HM-4b were destroyed during interim remedial activities. Lithologic logs for the monitor wells are included in Appendix C. IRA was completed in 1984. The MAP projects the Proposed Plan for DP13 will be completed in November 1993, and the final ROD will be complete in June 1994.

3.1.14 FSA-1

FSA-1 is located south and east of Facilities Building No. 14 (Figure 3.1-27). Groundwater in this area reportedly became contaminated by fuels leaking from the underground distribution system during the mid-1970s to the early 1980s. In 1988, the piping which consisted of 4-inch-diameter JP-4 lines, was abandoned. A fuel pumping station and two 12,000-gal USTs (USTs 19 and 20) were removed prior to December 22, 1988, which was the effective date of Federal Subtitle I regulations. These USTs were formerly located south of Facilities Building No. 14 and contained 2-butanone (UST 19) and xylenes (UST 20).

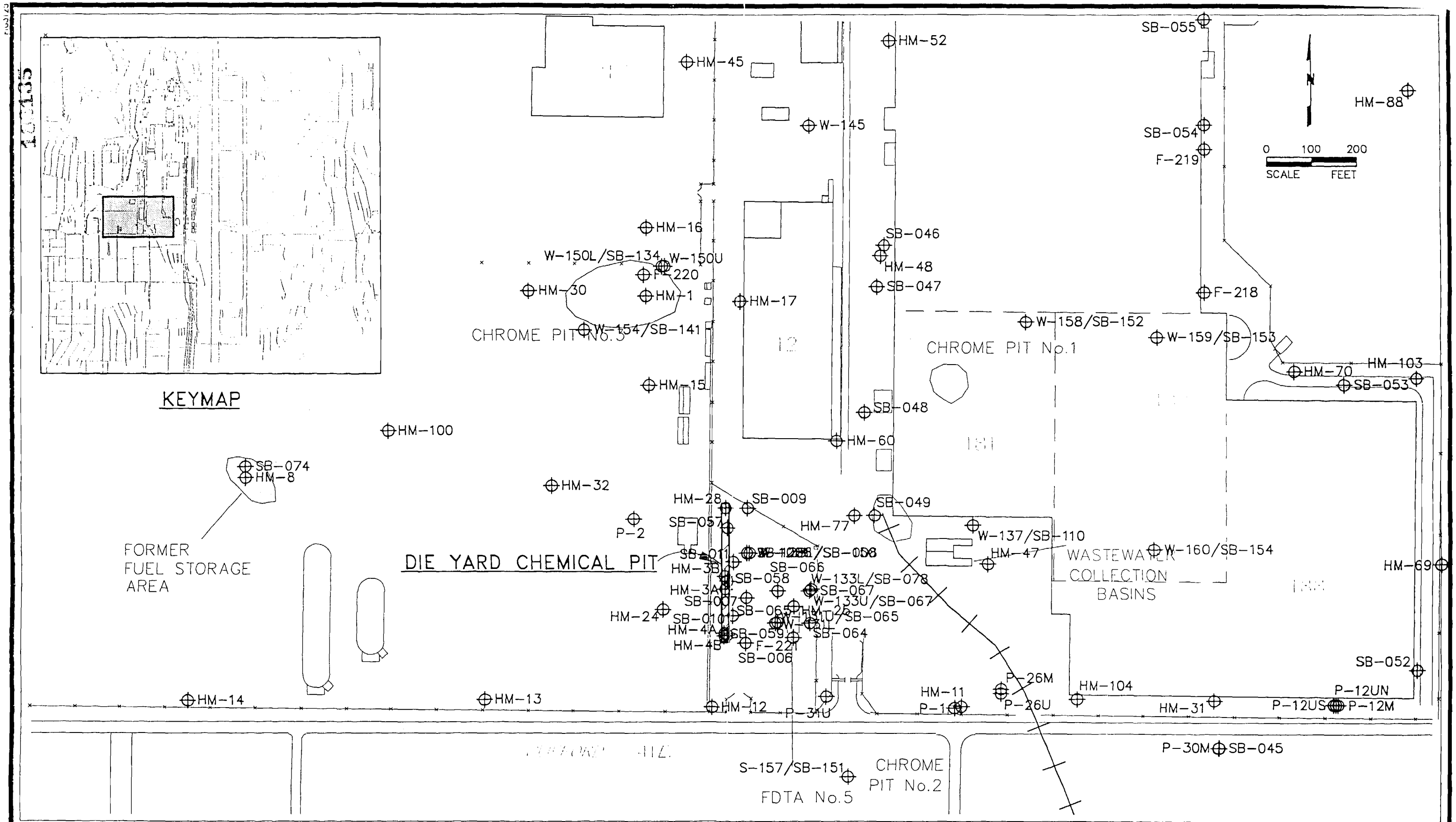
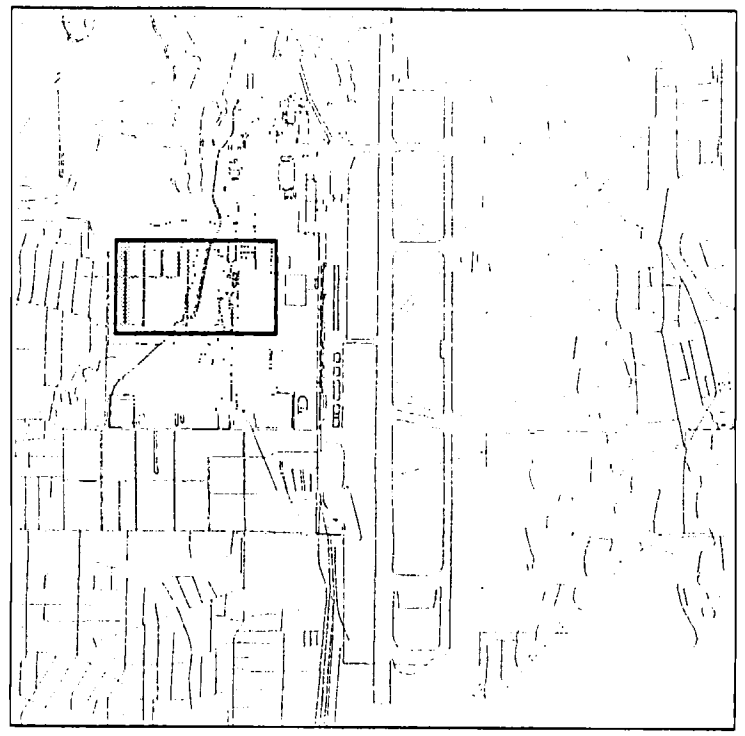


Figure 3.1-26
SAMPLE LOCATION MAP - DIE YARD CHEMICAL PIT

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A CALGON Company

FIG311



KEYMAP

LANDFILL No.3

FDTA No.2

FSA No.1

USTS 19 AND 20
(REMOVED)

N

0 100 200
SCALE FEET

Figure 3.1–27
SITE MAP – FUEL SATURATION AREA 1

SOURCE: ESE; GN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

Subsurface activities were conducted to determine the extent of soil and groundwater contamination present at FSA-1 and former UST Nos. 19 and 20. Soil borings and monitor wells were installed during the following investigations:

1. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, September 25, 1985 (1013);
2. IRP Phase II Confirmation/Quantification Stage II, Radian Corporation, December 1987 (1041);
3. Draft Remedial Action Plan and Conceptual Documents for Fuel Saturation Areas No.1 and 3, Intellus Corporation, July 1986 (1025); and
4. Preliminary Assessment/Site Investigation and Remedial Investigation, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. Studies containing specific information on FSA-1 and UST Nos. 19 and 20 are shown in Table 3.1-1.

To determine the groundwater quality in the upper zone flow system the following monitor wells were installed:

1. Wells H-53 and H-54 (installed during Phase II investigation activities);
2. Wells F-203 through F-207 and F-211 (installed during Draft Remedial Action Plan activities for FSA-1 and FSA-3); and
3. Wells W-136, W-139L, W-140L, W-141L, and W-147 (installed during Preliminary Assessment/Site Investigation and Remedial Investigation activities).

Two Paluxy monitor wells were installed during the Phase II investigation.

Following removal of the USTs, analytical results of soil samples collected from the UST excavations indicated the presence of 2-butanone and xylenes, compounds that are consistent with the former contents of the USTs.

Ethylbenzene was also detected, which could indicate JP-4 contamination from the adjacent leaking underground piping. The soil samples were collected above the saturated zone at a depth of 8 feet below ground surface (ft-bgs). No further remedial action was performed after removal of the USTs. The excavations were backfilled and paved (Hargis & Associates, Inc., 1989).

Prior to removal in 1984, Hargis & Associates, Inc. installed Wells HM-53, HM-55, P-6U, and P-6M, east of Facilities Building No. 14. Soil samples for chemical analyses were not collected from these borings. Intellus (1986) installed Wells F-203, F-204, F-205, F-206, F-207, and F-211 around the perimeter of Facilities Building No. 14, but soil samples were not collected for chemical analyses. Radian Corporation (1987) drilled a soil boring (Boring SB-4) east of Facilities Building No. 14 and collected two samples. One sample was collected from the vadose zone at 9 to 10 ft-bgs; the other sample was collected from the saturated zone at 25 to 25.5 ft-bgs. Hydrocarbons were detected only in the saturated zone sample. Figure 3.1-27 shows the location of the borings and monitor wells installed during previous investigations.

Previous investigations concentrated on obtaining groundwater quality data; therefore, the availability of chemical analyses of soil samples was limited to a single soil boring (Radian, SB-4) and several grab samples associated with the USTs excavation. The objective of the current investigation was to provide chemical analyses on soil samples that will more fully define the areal extent of potential contaminant source areas associated with leaks in the underground fuel lines and the former USTs. Previous sampling at the former USTs was also insufficient to determine if the saturated zone was impacted from the solvent products in the tanks.

Soil-gas measurements were performed along 300 ft of underground JP-4 fuel lines in an area suspected as the source of groundwater contamination. Soil

samples for chemical analyses were obtained from followup borings located adjacent to the fuel line and in the immediate area of the former USTs.

A soil gas survey and soil borings were also completed at FSA-1 and in the UST areas during the Preliminary Assessment/Site Investigation and Remedial Investigation. The soil gas survey was used as an initial screening process prior to soil sample collection. Soil samples were collected from soil gas survey points to determine the vertical and horizontal extent of contamination (Figure 3.1-28).

Five soil borings were installed in the former tank excavations. Soil borings contained large concentrations of VOCs and TPH. A chloroform concentration of 1,900,000 µg/kg and a bromodichloromethane concentration of 600,000 µg/kg were detected in one soil boring. Soil samples collected from soil borings drilled east and west of the product line contained high concentrations of TPH, VOCs, SVOCs and metals. The magnitude of TPH and VOC contamination detected in the soils in the vicinity of the product line and excavated tank locations indicates that leaks from these areas are the source of upper zone groundwater contamination.

A groundwater treatment system was put into service in October 1992. The groundwater treatment system consisted of an oil/water separator, air stripper, and two 10,000-lb carbon contractors. The system uses two extraction wells. A soil vacuum extraction system was put into service in 1992. The groundwater and soil treatment systems are currently in operation. The MAP projects the Proposed Plan for FSA-1 will be complete in November 1993, and the final ROD will be complete in June 1994.

3.1.15 FSA-2

FSA-2, located northwest of Facilities Building No. 176, was reportedly saturated by fuels leaking from a buried fuel pipeline in the 1970s and early 1980s (CH2M Hill, 1984) (Figure 3.1-29).

FIG311

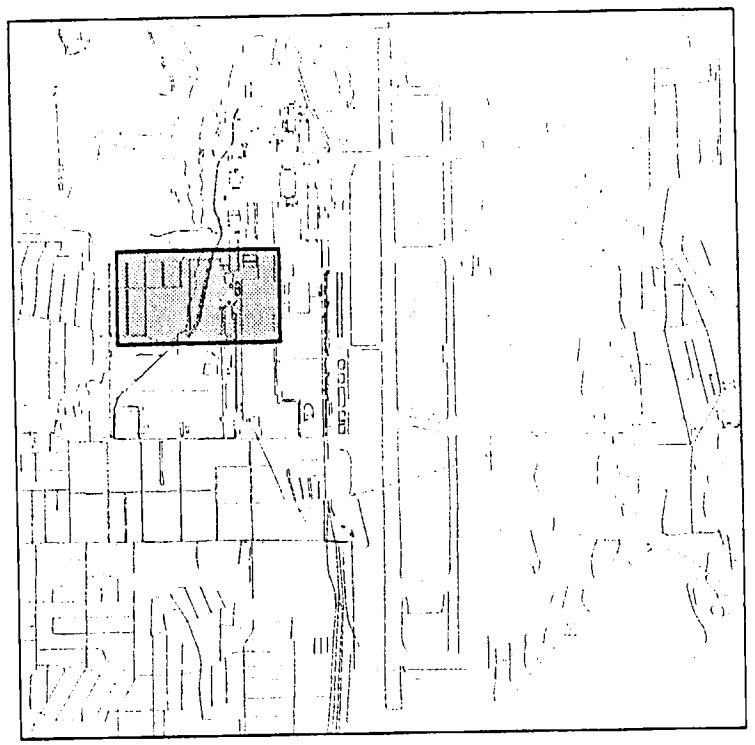
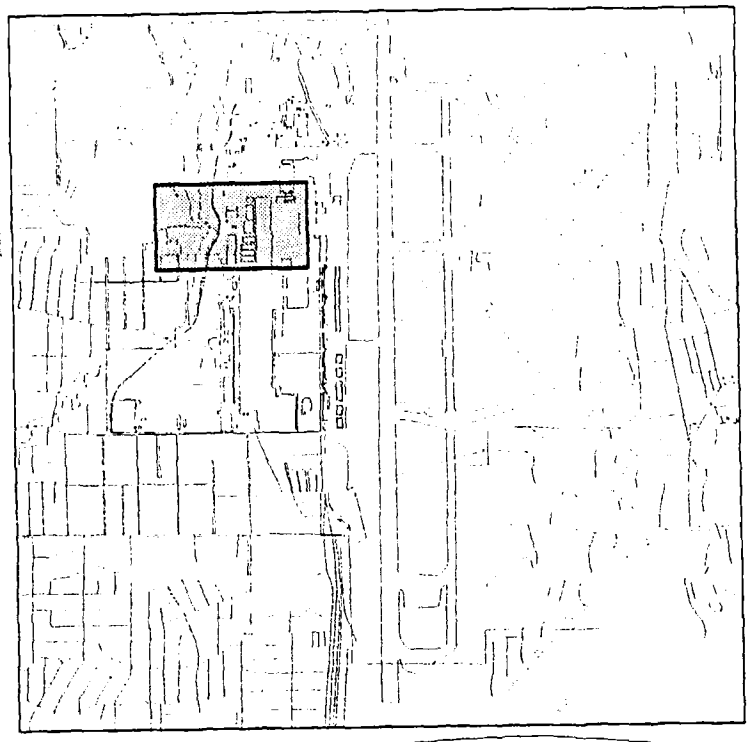


Figure 3.1-28
SAMPLE LOCATION MAP – FUEL SATURATION AREA 1

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

FIG3129



KEYMAP

Figure 3.1-29
SITE MAP - FUEL SATURATION AREA 2

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

Subsurface investigations were conducted to determine the extent of the soil and groundwater contamination present at FSA-2. Seven soil borings and three monitor wells were installed during the following investigations:

1. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, Inc., September 1985 (01013);
2. Ten-Site Investigation, Plant 4, Intellus Corporation, November 1986 (1026);
3. IRP Phase II, Confirmation/Quantification Stage I, Radian Corporation, December 1987 (01041); and
4. Preliminary Assessment/Site Inspection and Remedial Investigation, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. Reports containing specific information pertaining to FSA-2 are listed in Table 3.1-1.

To determine the hydrogeologic properties and groundwater quality in the upper zone flow system at FSA-2, the following monitor wells were installed:

1. Well HM-80 (installed during Phase II investigation activities);
2. Well F-212 (installed during ten-site investigation activities); and
3. Well W-135 (installed during Preliminary Assessment/Site Inspection and Remedial Investigation activities).

Sample locations are shown on Figure 3.1-30. Lithologic logs for the monitor wells are included in Appendix C.

Of the five soil borings drilled and sampled during previous investigations, only one shallow soil sample reportedly contained anomalous concentrations of VOCs and fuel-related hydrocarbons, none exceeding current federal standards. Samples from one or two groundwater monitor wells at FSA-2 also contained only trace amounts of fuel hydrocarbons. Soil samples were collected from five soil borings during the RI. Soil samples contained negligible amounts of TPH

FIG3129

KEYMAP

AIR MONITORING LOCATION

HM-106

HM-74

HM-73

FSA No.2

HM-80

W-135/SB-103

F-212

176

SOLVENT LINES

SB-035

HM-72

HM-75

SB-036

HM-58

OUTFALL No.5

OUTFALL No.4

HM-61

SW-7

SB-034

P-24M

P-24U

HM-65

HM-59

P-10M

P-10U

HM-76

HM-49

F-213

SB-068

HM-51

SB-071

SB-069

SB-070

SB-037

HM-79

SB-031

HM-54

FDTA No.2

HM-66

SW-6

SB-030

0 100 200

SCALE FEET

Figure 3.1-30
SAMPLE LOCATION MAP - FUEL SATURATION AREA 2

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.

A CILCORP Company

concentrations. Groundwater samples collected from the monitor wells located at FSA-2 contained undetectable amounts of contamination.

3.1.16 FSA-3

FSA-3, located immediately east of Meandering Road between Facility Building Nos. 157 and 142 (Figure 3.1-31), is contaminated from buried fuel pipelines that leaked during the 1970s and early 1980s. FSA-3 also has numerous underground utilities and several UST sites.

Subsurface investigations were conducted to determine the extent of soil and groundwater contamination at FSA-3. Fifteen soil borings and nineteen monitor wells (nine permanent and ten temporary) were installed during the following investigations:

1. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, Inc., September 1985 (01013);
2. Draft Remedial Action Plan and Conceptual Documents for FSA 1 and FSA 3, Intellus Corporation, July 1986 (01025);
3. Evaluation of Condenser Pipeline and Remedial Measures, Fuel Saturation Area No. 3, Hargis & Associates, Inc., July 1988 (1043); and
4. Preliminary Assessment/Site Inspection and Remedial Investigation, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. Reports containing specific information pertaining to FSA-3 are listed in Table 3.1-1.

To determine the hydrogeologic properties and groundwater quality in the upper zone flow system at FSA-3, the following monitor wells were installed:

1. Wells HM-78 and HM-80 (installed during Phase II investigation activities);

FIG3131

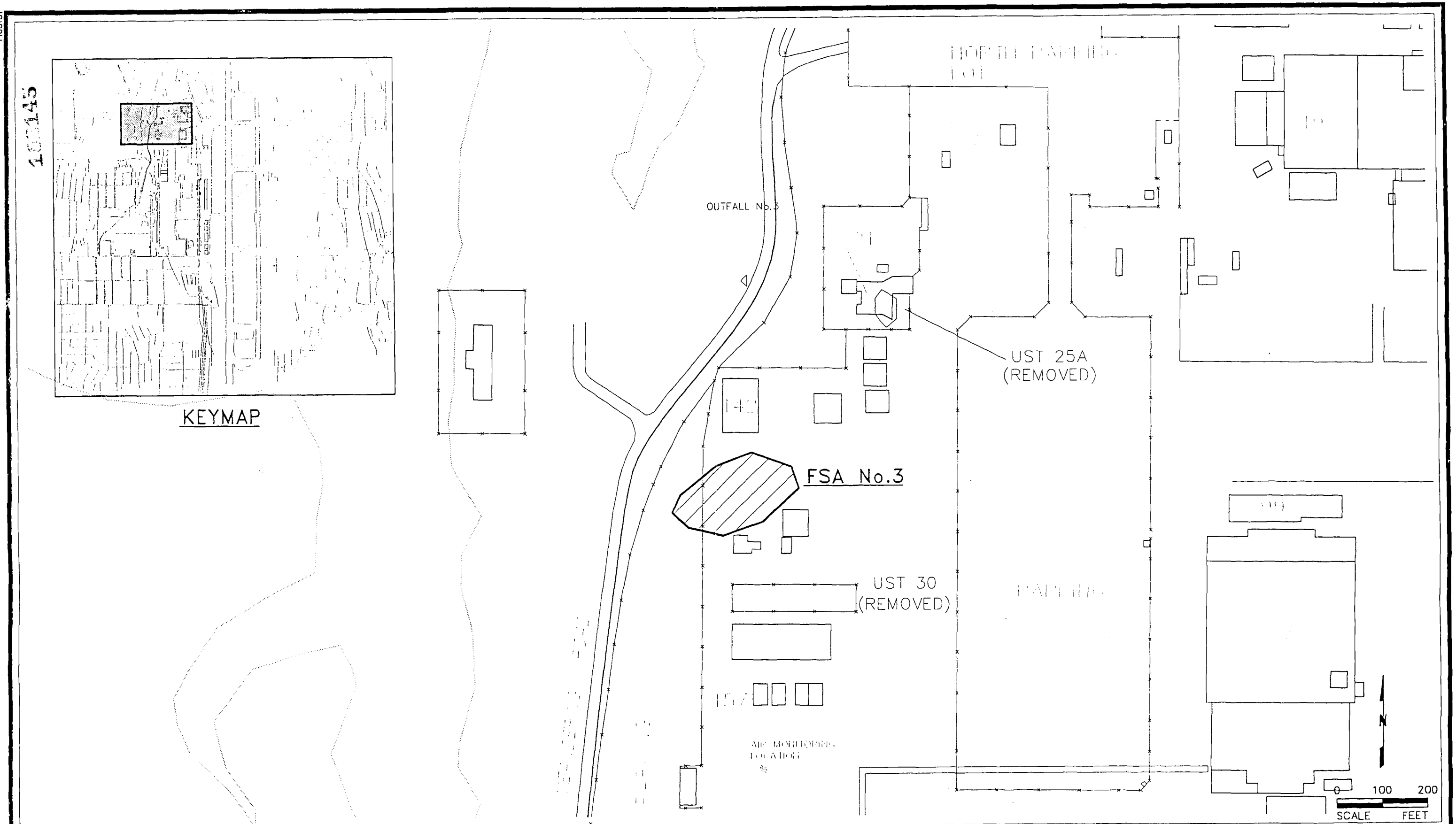


Figure 3.1–31
SITE MAP – FUEL SATURATION AREA 3

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A CALCORP Company

2. Wells F-200, F-201, F-202, F-208, F-210, F-222, and F-223 (installed during draft remedial action plan for FSA-1 and FSA-3);
3. Wells FSA 3-1, 3-2, 3-3, 3-4, 3-6, 3-7, 3-8, 3-10, 3-11 and 3-12 (temporary wells installed during the evaluation of condenser water pipeline and remedial measures investigation activities); and
4. Well W-143 (installed during the RI activities).

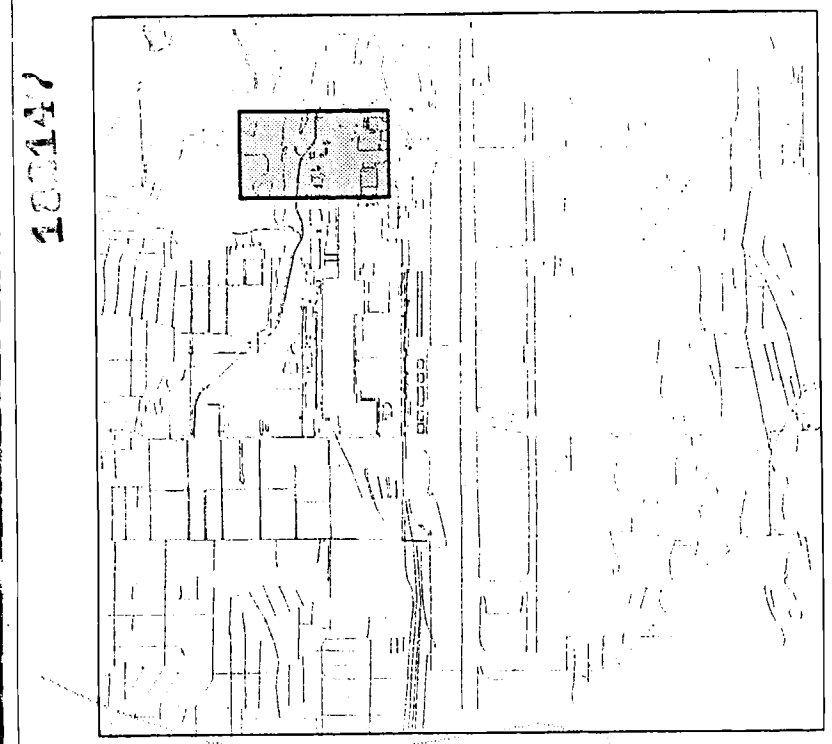
Soil boring and monitor well locations are shown on Figure 3.1-32. Lithologic logs are included in Appendix C.

Fuel-related floating product has been observed in seven of the nine monitor wells at FSA-3. Analytical results of groundwater samples show that the groundwater at FSA-3 contains concentrations of VOCs, SVOCs, and fuel hydrocarbons. Contaminants found in groundwater exceeding Federal standards include benzene, ethylbenzene, toluene, TCE, chlorobenzene, and naphthalene.

Intellus Corporation conducted a geophysical survey over the FSA-3 area to delineate the extent of contamination. Six wells were installed to determine the extent of groundwater contamination in the upper zone flow system. Free product, consisting of JP-4, was detected in Wells F-201, F-201, and HM-78; fuel-related hydrocarbons were detected in Wells F-200 and F-210; TCE was detected in Wells F-200, F-202, F-210, and HM-78; and chlorinated solvent was detected in Well F-208.

Hargis & Associates, Inc. installed soil borings and monitor wells during the condenser water pipeline investigation. The subsurface investigation was conducted to determine the extent of free product and to determine the location for a pipeline cutoff wall system to prevent the spread of contamination. Fuel vapors and free product were detected in the subsurface throughout the fuel test area.

FIG3131



KEYMAP

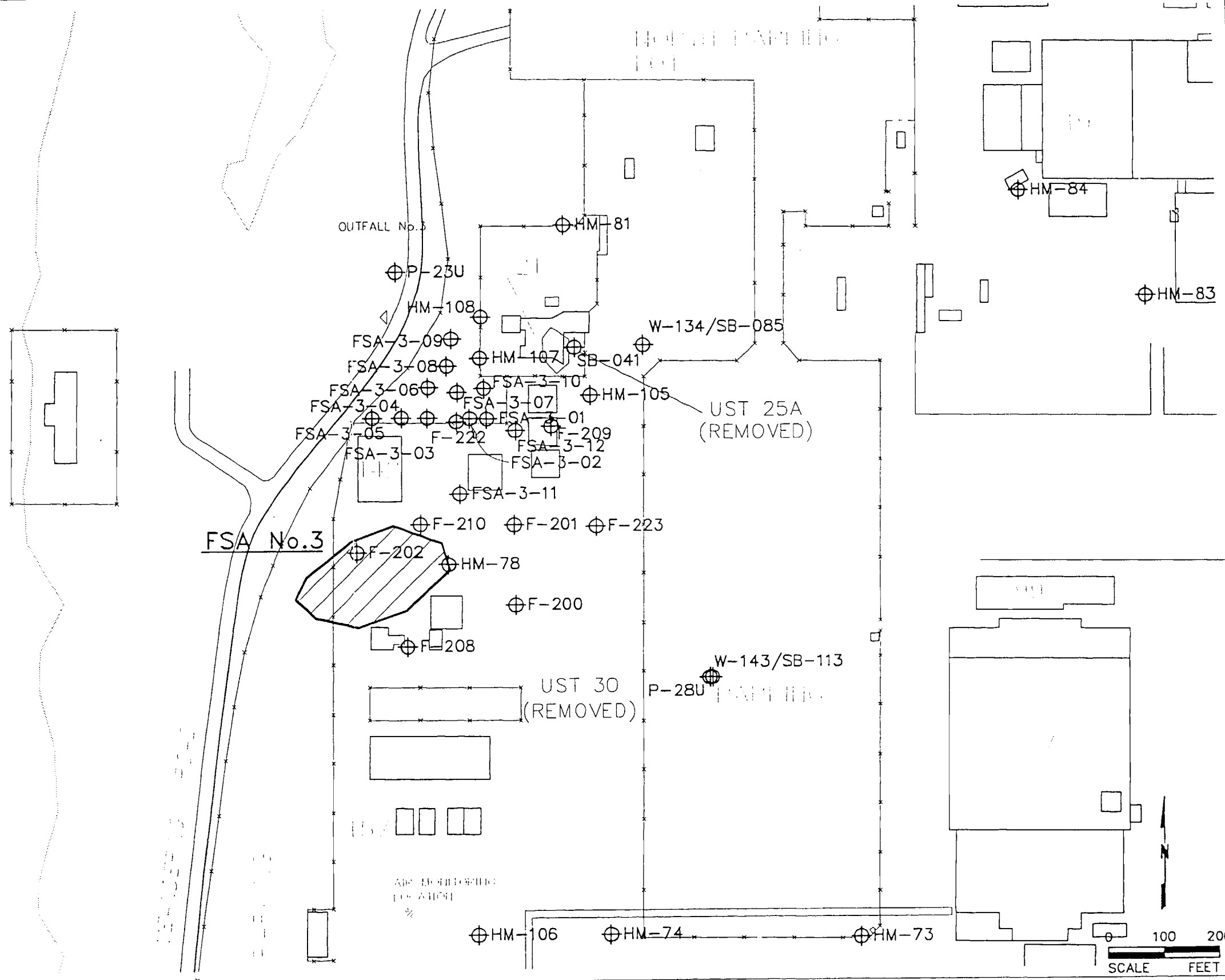


Figure 3.1-32
SAMPLE LOCATION MAP - FUEL SATURATION AREA 3

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

During the RI, a soil gas survey was performed to delineate the lateral extent of soil contamination. On the basis of the soil gas survey, 19 soil borings were drilled to define the vertical and lateral extent of soils contamination. Four soil borings were installed around the perimeter of former UST No. 30, which was located southeast of FSA-3. An additional source of contamination was found. A 1942 abandoned fuel pipeline was discovered which passes east of FSA-3. Three soil borings and one monitor well (Well W-134) were installed to determine the extent of contamination.

Significant contamination by JP-4-related compounds was found in soils at FSA-3. The highest concentration of contaminants is from a suspected leak in a product delivery line. This same product line is the probable cause for the groundwater contamination detected in the monitor wells. Two additional areas of contamination are located east of FSA-3. The sources of contamination for these areas are likely minor leaks of product lines or fuel-related activities at the surface. The estimated volume of TPH contaminated soils is 40,000 yd^3 (Geotech, 1992).

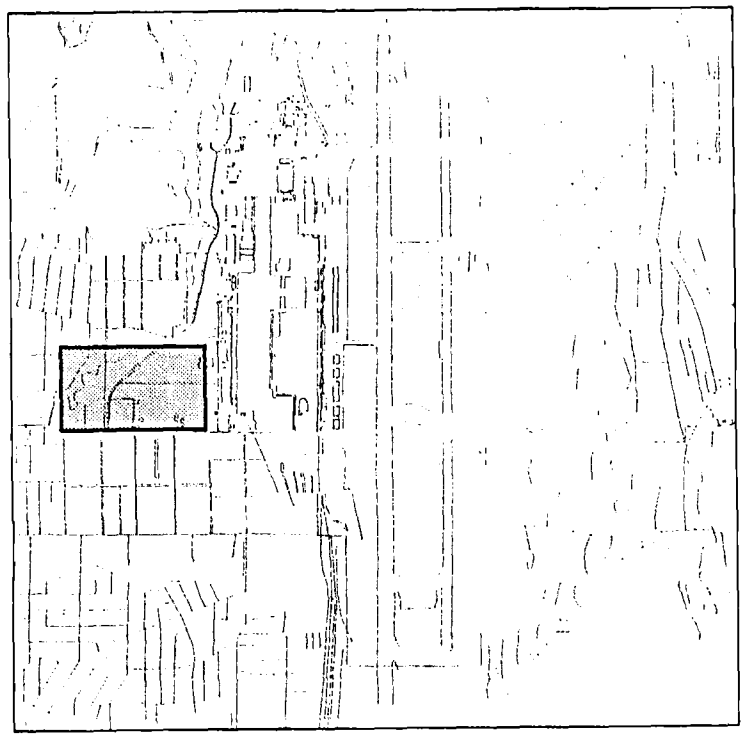
A groundwater treatment system consisting of eight extraction wells, in oil/water separator and a low-profile air stripper was put into service in October 1992. An IRA soil vacuum extraction system was put into service for several months in 1992 for a pilot study. A permanent soil vacuum extraction system was put into service in December 1992. The groundwater treatment system and the soil vacuum extraction system are currently in operation. The MAP projects the Proposed Plan for FSA-3 will be completed in November 1993, and the final ROD will be completed in June 1994.

3.1.17 FFSA

A 100,000-gal aboveground JP-4 storage tank was located at the southwest corner of AFP4 near the center of the radar range (Figure 3.1-33). In use from the early 1940s to 1962, the storage tank was suspected to have leaked. The

FIG3133

10214J



KEYMAP

LANDFILL No.4

FDTA No.3

LANDFILL No.2

FORMER FUEL STORAGE AREA

0 100 200

SCALE FEET

Figure 3.1–33
SITE MAP – FORMER FUEL STORAGE AREA

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.

A CH2M HILL Company

tank was removed from the site and relocated in 1962. Soil beneath the tank was reportedly saturated with jet fuel at the time of removal (Hargis & Montgomery, 1983). Hargis & Montgomery reports that the buried pipeline transporting fuel from the area leaked on several occasions. This site is identified as FFSA.

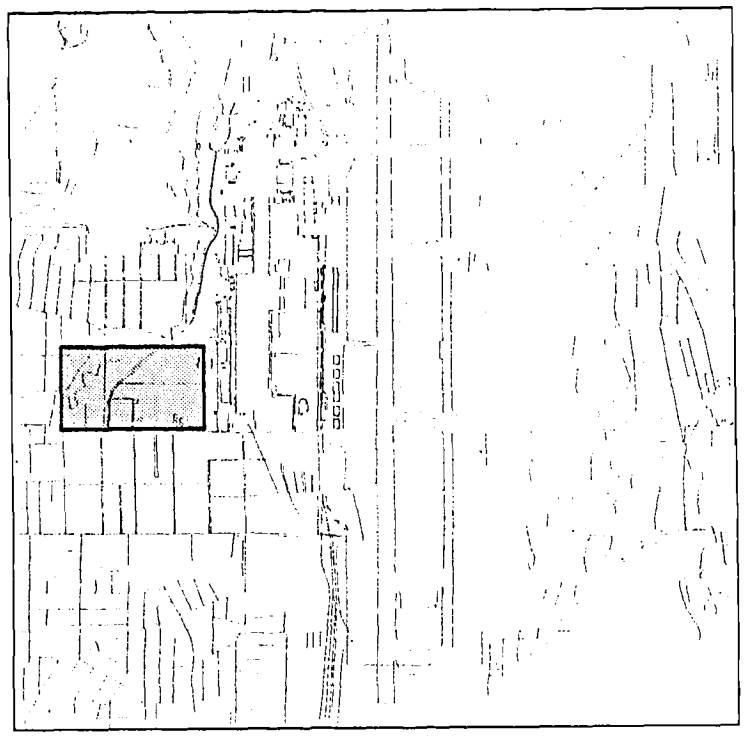
Subsurface assessment activities were conducted to determine the extent of contamination present in soils and groundwater at FFSA. Five soil borings and two shallow monitor wells were installed during the following studies:

1. Phase I Investigation, Drilling and Construction of Upper Zone Test Holes and Monitor Wells, Hargis & Montgomery, January 1983 (1001);
2. Phase I Investigation of Subsurface Conditions, Hargis & Montgomery, February 1983 (1002);
3. IRP Phase II Confirmation/Quantification Stage I, Radian Corporation, December 1987 (1041); and
4. Preliminary Assessment/Site Investigation and Remedial Investigation, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. Lithologic logs for the monitor wells are included in Appendix C. Reports containing site-specific information on FFSA are listed in Table 3.1-1. Soil boring and monitor well locations are shown on Figure 3.1-34.

Hargis & Montgomery drilled one test hole (TH-9) and one monitor well (Well HM-8) in December 1982, under the previous fuel tank site (Figure 3.1-34). No contamination was detected in TH-9. Well HM-8 soil samples were collected from four depth intervals and analyzed for trace metals, cyanide, VOCs, oil and grease, and jet fuel. No significant trace metals or cyanide were detected. Relatively low levels of VOCs, SVOCs, and oil and grease were found in soil samples collected during the installation of HM-8 (Hargis &

FIG3133



KEYMAP

SW-3
P-25M
P-25U
HM-46
HM-2
HM-102
HM-41
SB-005
TANK 3
HM-33
P-21U
HM-9
SB-004
SW-2
SB-003
HM-101
HM-42
HM-5
LANDFILL No.4
SB-002
SB-001
HM-43
LANDFILL No.2
HM-40
P-20M
HM-30
HM-44
W-154/SB-141
HM-22
HM-100
SB-074
HM-8
HM-32
EPA-4
FORMER FUEL STORAGE AREA
N
0 100 200
SCALE FEET

Figure 3.1-34
SAMPLE LOCATION MAP - FORMER FUEL STORAGE AREA

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

Montgomery, 1983). The primary contaminants found include oil and grease, methylene chloride, and di-n-butyl phthalate. Removal of the soils was not reported.

Four soil borings (Borings SB-074 through SB-077) were installed during the Preliminary Assessment/Site Investigation and Remedial Investigation. Soil samples submitted for laboratory analysis contained negligible concentrations of TPH and fuel-related hydrocarbons.

No significant concentrations of COCs or other contaminants were found during RI activities. Soils previously contaminated by jet fuel have been excavated and removed from the site.

3.1.18 SOLVENT LINES

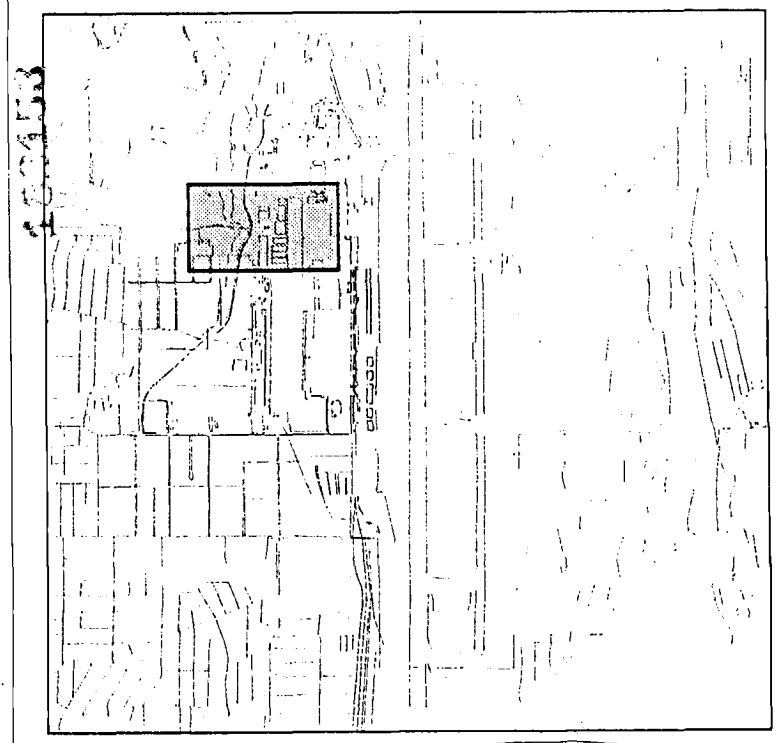
Solvent lines reportedly leaked during the early 1940s before being drained, capped, and abandoned in 1944. The actual locations of the leaks was not determined in the Phase I study. These solvent lines reportably contained xylene, methylethyl ketone, and kerosene. The solvent lines run east to west and are located north of the Assembly building, west of FSA-2, and southeast of FSA-3 (Figure 3.1-35).

Subsurface investigations were conducted to determine the extent of soil and groundwater contamination present at the solvent line site. Five monitor wells were installed during the following investigations:

1. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, Inc., September 1985 (01013); and
2. IRP, Phase II Confirmation/Quantification, Stage I, Radian Corporation, December 1987 (01041).

Summaries of these reports are included in Appendix A. Reports containing specific information concerning the solvent line site are listed in Table 3.1-1.

FIG3135



KEYMAP

SOLVENT LINES

SOLVENT LINES

FSA No.2

170

OUTFALL No.5

OUTFALL No.4

P-24M

P-24U

P-10M

P-10U

FDTA No.2

0 100 200

SCALE FEET

N

Figure 3.1-35
SITE MAP - SOLVENT LINES

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.

A CH2MHILL Company

To determine hydrogeologic properties and groundwater quality in the upper zone flow system at the solvent line site, the following five monitor wells were installed:

1. Wells HM-72, HM-73, HM-74, and HM-75 (installed during the Phase II investigation activities); and
2. Well HM-106 (installed during the IRP Phase II investigation activities).

Sample locations are shown on Figure 3.1-36. Lithologic logs for the monitor wells are included in Appendix C.

Groundwater and soil samples collected from these monitor wells contained undetectable concentrations of oil and grease, xylene, and methylethyl ketone. A no further IRP action recommendation was made during the IRP Phase II investigation for the solvent line site. The no further action recommendation was accepted and no further action status was granted to the solvent line area.

3.1.19 NARF AREA

NARF, formerly located at the north end of AFP4, housed several experimental reactors between 1953 and 1974 (Figure 3.1-37). Large quantities of nuclear activation material were produced at this site as an undesirable byproduct of neutron bombardment. Those activation products were reportedly contained at the site. NARF was decommissioned and disposed of by a contractor in 1974. More than 2-million pounds (lb) of miscellaneous parts and 15-million lb of concrete rubble were hauled offsite to Barnwell, South Carolina. Post-closure inspection of this site revealed no remaining contamination (CH2M Hill, 1984)

Subsurface investigations were conducted at this site to determine the extent of soil and groundwater contamination present at NARF. Four soil borings and three monitor wells were installed during the following investigations:

FIG3135

KEYMAP

AIR MONITORING LOCATION

HM-106

HM-74

HM-73

SOLVENT LINES

HM-80

W-135/SB-103

F-212

FSA No.2

SOLVENT LINES

SB-035

HM-72

HM-75

SB-036

HM-58

OUTFALL No.5

OUTFALL No.4

SW-7

HM-61

SB-034

P-24M

P-24U

HM-65

HM-59

P-10M

P-10U

HM-76

HM-49

F-213

SB-068

HM-51

SB-071

SB-069

SB-070

SB-031

SB-037

HM-79

FDTA No.2

HM-54

SW-6

SB-030

HM-66

0 100 200

SCALE FEET

Figure 3.1-36
SAMPLE LOCATION MAP - SOLVENT LINES

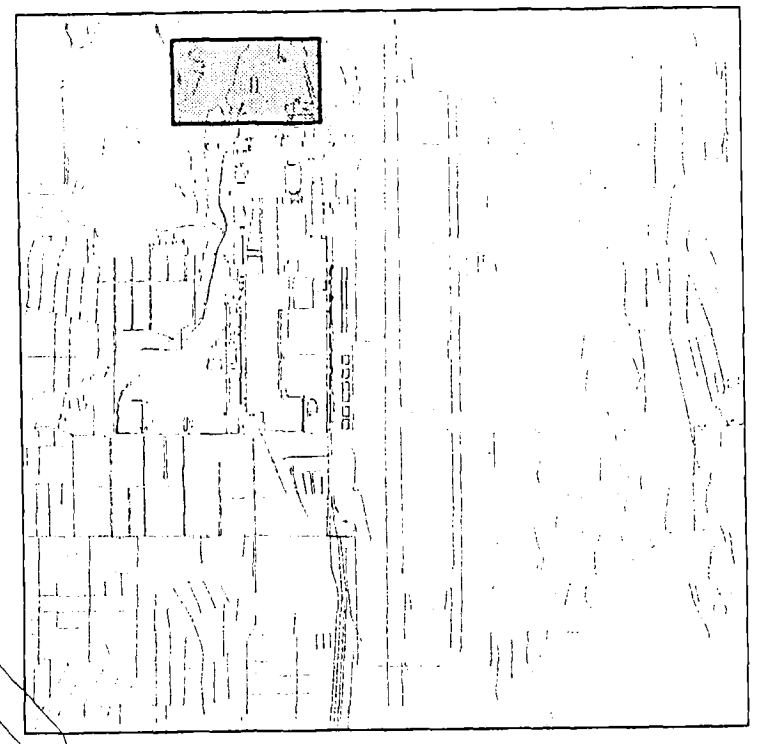
SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.

A CALCORP Company

FIG3137

10015S



KEYMAP

Figure 3.1-37
SITE MAP - NUCLEAR AEROSPACE RESEARCH FACILITY

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

1. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, Inc., September 1985 (1013); and
2. IRP Phase II, Confirmation/Quantification, Stage I, Radian Corporation, December 1987 (1041).

Summaries of these reports are included in Appendix A. Reports containing specific information pertaining to NARF are listed in Table 3.1-1.

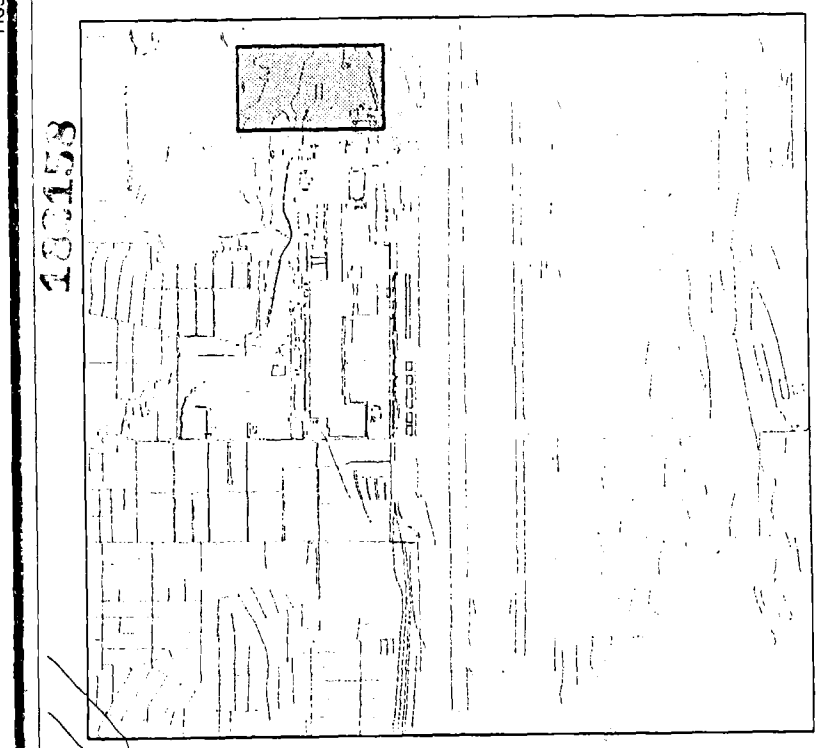
To determine groundwater quality in the upper zone flow system, monitor wells (Wells HM-83, HM-84, and HM-85) were installed during the Phase II investigation (Figure 3.1-38). Groundwater samples were analyzed for VOCs, BNA, heavy metals, oil and grease, radioactive material (RAM), and fuel-related hydrocarbons. No contaminants were detected.

Four soil borings were drilled at NARF (Figure 3.1-38). Soil samples were submitted to a laboratory and analyzed for alpha, beta, and gamma radiation. Soil samples contained detectable amounts of alpha and beta radiation; however, the amount of radiation present suggests that no residual radiation is present above acceptable levels at this site (Radian, 1987). No further action status was granted to the NARF area.

3.1.20 WASTEWATER COLLECTION BASINS (WWCB)

WWCB, located south of the process building (Facilities Building No. 181), consists of two plastic-lined concrete waste basins, each with an approximate capacity of 85,000 gal, designed to collect and settle suspended solids from plant wastewater (Figure 3.1-39). IRP Phase I investigations determined that several spills from vapor degreasers in the process building (primarily TCE) have flowed to the basins through floor drains, and that other chemical spills may have entered the basins through floor drains. The integrity of the liner coating the concrete basins had not been evaluated for several years. It is suspected that a

FIG31.37



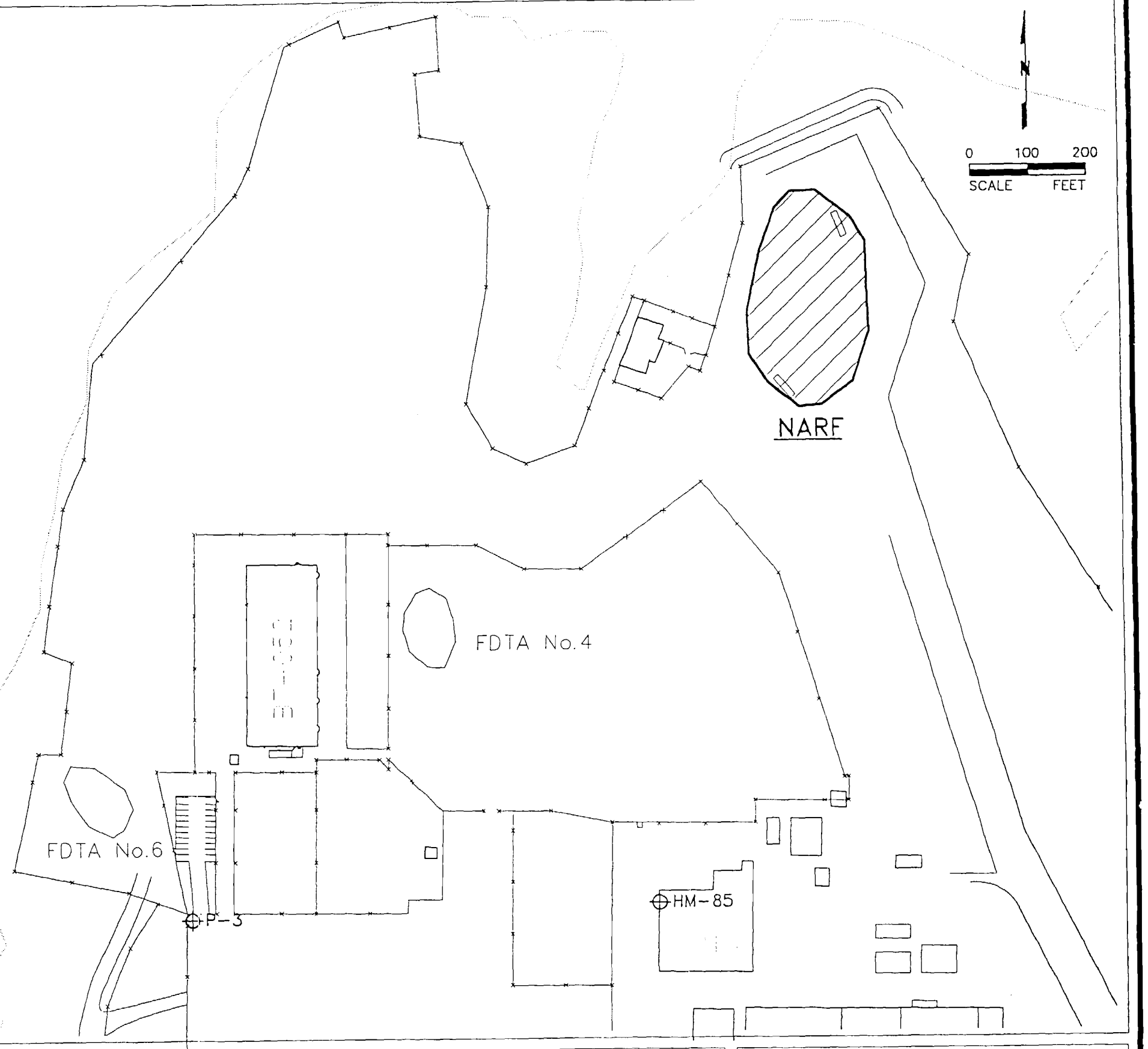
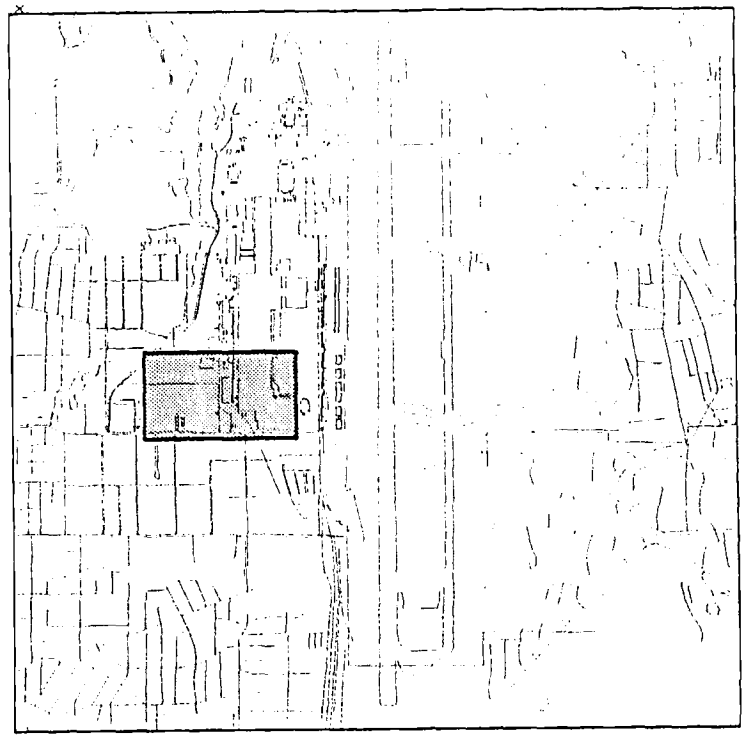


Figure 3.1-38
SAMPLE LOCATION MAP - NUCLEAR AEROSPACE RESEARCH FACILITY

SOURCE ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

FIG3139



KEYMAP

CHROME PIT No.3

CHROME PIT No.1

CHROME
PIT No.2

FORMER
FUEL STORAGE
AREA

DIE YARD
CHEMICAL PITS

FDTA No.5

WASTEWATER COLLECTION BASINS

0 100 200
SCALE FEET

Figure 3.1-39
SITE MAP - WASTEWATER COLLECTION BASINS

SOURCE: ESE, CH GEOTECH

Environmental
Science &
Engineering, Inc.
A CELCORP Company

crack in the basin floor or wall may have allowed contaminants to leak to the surrounding soils.

Subsurface investigations were conducted to determine the extent of contamination present in the soils and groundwater at WWCB. Four soil borings and two monitor wells were installed during the following investigations:

1. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, Inc., September 1985 (01013);
2. Ten-Site Field Investigation, Plant 4, Intellus Corporation, November 1987;
3. IRP Phase II, Confirmation/Quantification, Stage I, Radian Corporation, December 1987 (01041); and
4. Preliminary Assessment/Site Inspection and Remedial Investigation, Geotech, December 1992 (X07).

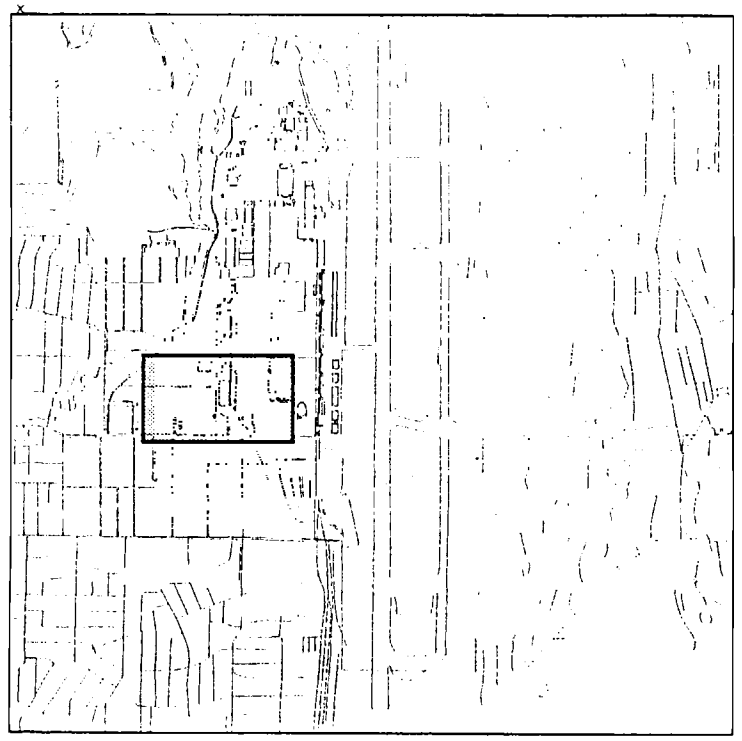
Summaries of these reports are included in Appendix A. Reports containing specific information pertaining to WWCB are listed in Table 3.1-1.

To determine hydrologic properties and groundwater quality in the upper zone flow system at WWCB, the following monitor wells were installed:

1. Well HM-47 (installed during the Phase II investigation activities), and
2. Well HM-104 (installed during the IRP Phase II investigation activities).

Soil boring and monitor well locations are shown on Figure 3.1-40. Lithologic logs for the monitor wells are included in Appendix C.

Groundwater samples were previously collected from Well HM-47 southeast of WWCB. Analytical results from these samples indicate that the groundwater is contaminated with VOCs and heavy metals. It is uncertain whether the VOCs in



KEYMAP

HM-45
HM-52
SB-055
W-145
HM-88
SB-054
F-219
0 100 200
SCALE FEET
HM-16
SB-046
W-150L/SB-134
W-150U
F-220
HM-48
HM-30
HM-1
SB-047
HM-17
F-218
W-154/SB-141
W-158/SB-152
W-159/SB-153
CHROME PIT No.3
CHROME PIT No.1
HM-103
HM-70
SB-053
HM-15
SB-048
HM-60
HM-100
SB-074
HM-8
HM-32
CHROME PIT No.2
HM-28
SB-009
SB-049
SB-057
HM-77
W-137/SB-110
P-2
SB-011
HM-47
W-160/SB-154
DIE YARD CHEMICAL PITS
HM-3B
SB-066
HM-69
SB-058
W-133L/SB-078
HM-3A
SB-067
WASTEWATER COLLECTION BASINS
SB-007
W-133U/SB-067
HM-24
SB-010
SB-065
HM-4A
SB-059
SB-064
HM-4B
F-221
SB-006
SB-052
FORMER FUEL STORAGE AREA
P-26M
HM-104
P-12UN
HM-14
HM-13
HM-12
P-31U
HM-11
P-26U
HM-31
P-12US
P-12M
P-30M
SB-045
S-157/SB-151

Figure 3.1-40
SAMPLE LOCATION MAP - WASTEWATER COLLECTION BASINS

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A DILCORP Company

groundwater at this location can be attributed to WWCB. The presence of TCE in the groundwater indicates that the source is related to the process building (vapor degreaser spills). A sanitary sewerline runs east to west under the site; a storm drain, which runs northwest to southeast, is located approximately 75 ft south of WWCB. Other upgradient sources, such as Chrome Pit No. 2 and DP13 may be the source of heavy metals found in the groundwater samples. Several organic compounds were present in samples from the downgradient well. These include TCE, trans-1,2-DCE, and chlorobenzene.

Two soil borings (Borings SB-059 and SB-110) and a visual inspection of the WWCB were completed during RI activities. Upon visual inspection of the north basin, the concrete of the basin did not exhibit cracks or flaws; however, parts of the floor liner were missing (approximately 60 percent) and cracked in places along the walls. According to General Dynamic employees, the south basin had more liner missing than the north basin.

Soil samples collected from Boring SB-110 contained a small amount of contamination (TCE at 7 μg/kg and TPH at 29 mg/kg). Soil sample results from these boreholes do not indicate that soil contamination is present at WWCB. Groundwater samples collected from monitor wells contained VOCs (solvents) and TPH (Geotech, 1992).

3.1.21 EAST PARKING LOT

The East Parking Lot area is located east of the assembly building/parts plant (Figure 3.1-41). Subsurface investigations in this area have determined that the Walnut Formation is either thinned out or eroded under the East Parking Lot. The East Parking Lot has been referred to as the Window Area. Geophysical and soil boring evidence suggests that the Walnut Formation was eroded by the White River prior to the deposition of alluvial material. A paleochannel exists below Grant's Lane in the vicinity of Well HM-82. Contamination from the

FIG3141

18163

KEYMAP

EAST PARKING LOT AREA

0 100 200
SCALE FEET

OUTFALL No.1

Figure 3.1-41
SITE MAP - EAST PARKING LOT AREA

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A CELCORP Company

upper zone flow system is suspected to migrate vertically into the Paluxy aquifer through the Window Area in the Walnut Formation.

Subsurface investigations have been conducted to determine the extent of oil and groundwater contamination in the East Parking Lot area. Numerous soil borings and monitor wells have been installed during the following investigations:

1. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, Inc., September 1985 (1013);
2. Investigation of Groundwater Pollution at Plant 4, U.S. Corp of Engineers, October 1986 (X03);
3. Summary Report for Window Area Investigation, Hargis & Associates, Inc., April 1987 (1028);
4. Summary of Interim Remedial Investigations, January 1987 to April 1989, Plant 4, Hargis & Associates, Inc., July 1989 (3010); and
5. Preliminary Assessment/Site Inspection and Remedial Investigation, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. Reports containing specific information pertaining to the East Parking Lot (Window Area) are listed in Table 3.1-1.

To determine hydrogeologic properties and groundwater quality in the upper flow zone in the East Parking Lot, the following monitor wells were installed:

1. Wells HM-67, HM-68, and HM-82 (installed during the Phase II investigation);
2. Well HM-86 (installed during the Window Area investigation activities);
3. Wells HM-87 to HM-97, HM-98, HM-99, HM-110, HM-113, HM-114, and HM-127 (installed during interim remedial investigations activities); and

4. Wells W-149, W-151, W-152, W-153, W-155, and W-156 (installed during the RI activities).

To determine the groundwater quality and hydrologic characteristics of the Paluxy aquifer, the following monitor wells were installed:

1. Wells P-14 and P-14u (installed during the Window Areas investigation activities); and
2. Wells P-8us, P-8un, P-11us, P-13us, P-15u, P-15us, P-16us, P-17us, P-18us, and P-19us (installed during interim RI activities).

Monitor and soil boring locations are shown on Figure 3.1-42. Lithologic logs for the monitor wells are included in Appendix C.

Much information was collected in this area; however, the extent (downgradient) of contamination has not been determined. Groundwater samples collected from upper zone flow system monitor wells indicate that this area is contaminated with TCE and TCE degradation products. Contamination found in this area has moved off AFP4 property and onto CAFB property (flightline area).

Groundwater samples collected from the Paluxy monitor wells in the East Parking Lot area contain TCE and TCE degradation products. The presence of the contamination reflected the Window Area located in the Walnut Formation aquiclude. The contamination located in the Paluxy Formation aquifer has migrated to CAFB.

The Window Area groundwater treatment system is currently under construction. The treatment system consists of eight extraction wells, an equalization basin, bag filters, air strippers (with carbon absorption for air emissions), and carbon absorption polishing. A groundwater seepage treatment system consisting of a low-profile stripper has been installed and is currently in operation. The taper-edge treatment system treats water that seeps into a deep pit in Building 181.

FIG3141

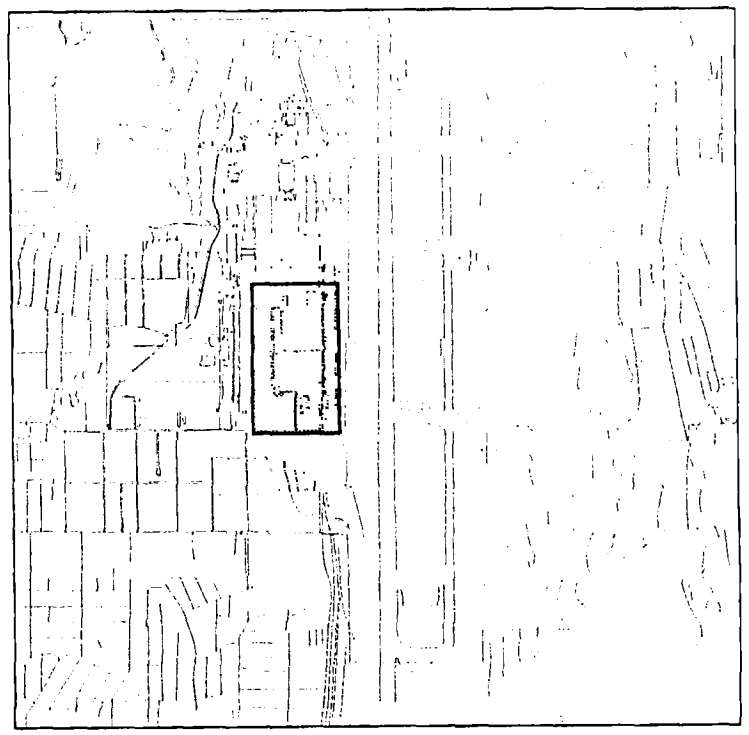


Figure 3.1-42
SAMPLE LOCATION MAP - EAST PARKING LOT AREA

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

Schedules for Window Area remediation and the taper-edge treatment system were not available.

3.1.22 JETS

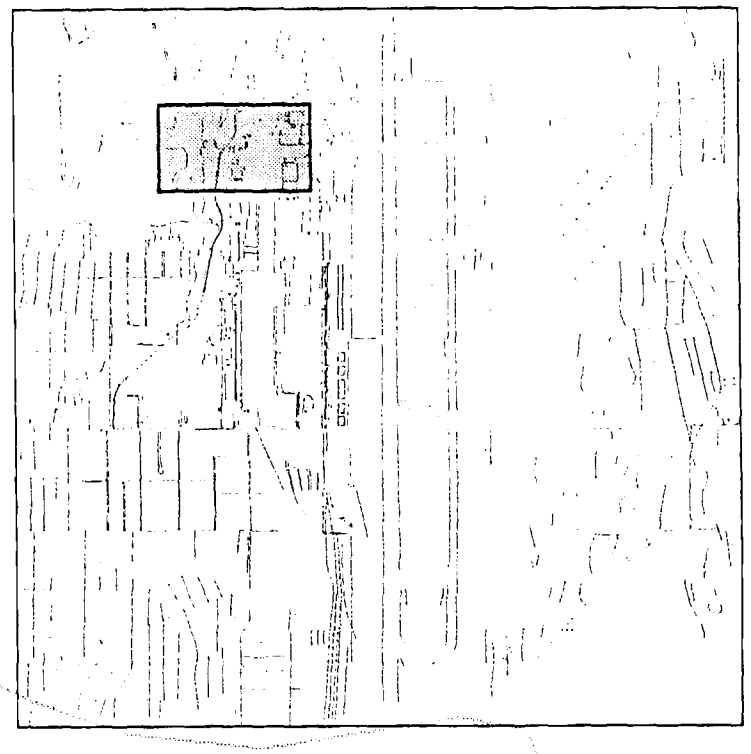
JETS, located northeast of Facilities Building No. 142 and east of Meandering Road (Figure 3.1-43), was identified during the IRP Phase II investigation as a site containing fuel-related contamination in soils and groundwater. The site is located north of a fuels test area and FSA-3, a known area of fuel contamination.

There appears to be several possible sources for contamination at JETS. Possible sources for contamination include Facilities Building No. 21 and the sump constructed at JETS which was used to collect water for cooling, noise suppression, and building cleanup. Adjacent to JETS and Facilities Building No. 21 were two USTs once used for fuel storage. North of JETS is an active UST containing JP-4. Both the sump and the abandoned tanks were suspected sources of contaminants. Soil samples collected from the five soil borings at JETS contained anomalous concentrations of fuel hydrocarbons and oil and grease. Groundwater samples collected from four monitor wells at JETS indicated that two of the wells contained fuel-related hydrocarbons.

Subsurface assessment activities were conducted to determine the extent of contamination present in the soil and groundwater at JETS. Five soil borings and five upper zone monitor wells were installed during the following studies:

1. Phase II Investigation of Subsurface Conditions, Hargis & Associates, Inc., September 1985 (1013);
2. IRP Phase II, Confirmation/Quantification Stage I, Radian Corporation, December 1987 (1041); and
3. PA/SI/RI, Geotech, December 1992 (X07).

FIG3143



KEYMAP

OUTFALL No.5

JET ENGINE TEST STAND

UST 25A
(REMOVED)

FSA No.3

UST 30
(REMOVED)

N

0 100 200
SCALE FEET

Figure 3.1-43
SITE MAP - JET ENGINE TEST STAND

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A GILCORP Company

Summaries of these reports are included in Appendix A. Soil boring and monitor well locations are shown on Figure 3.1-44. Lithologic logs for the monitor wells are included in Appendix C.

To determine groundwater quality in the upper flow system, the following monitor wells were installed:

1. Well HM-81 (installed during Phase II investigation);
2. Wells HM-105, HM-107, and HM-108 (installed during IRP Phase II); and
3. Well W-134 (installed during PA/SI/RI).

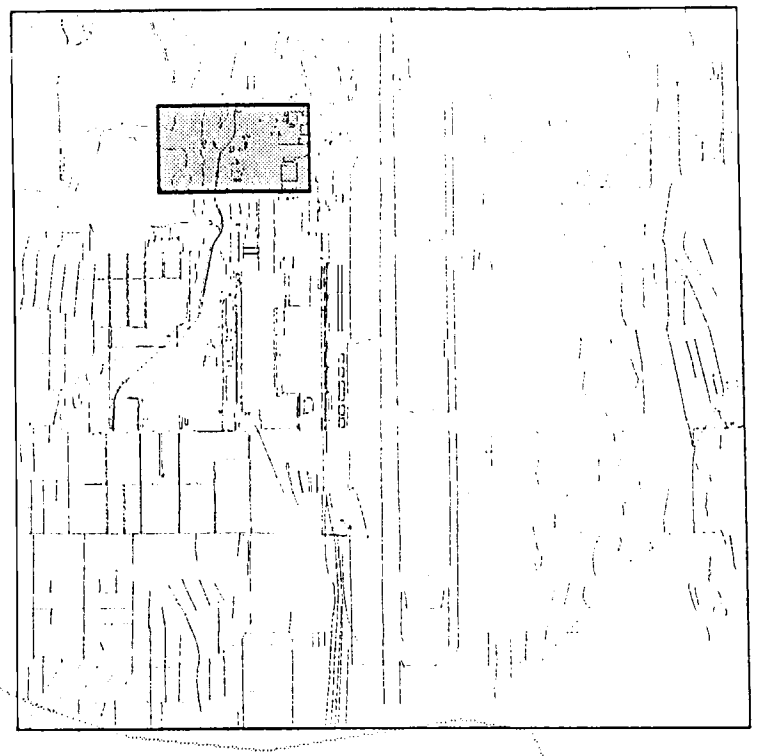
Although the site was recommended for no-further action, previous data indicate that contaminants are present at the site. The monitor wells and soil borings installed during the IRP Phase II investigation indicated that contamination was present. One soil boring (Boring SB-9) drilled during the IRP Phase II investigation encountered liquid hydrocarbons. To define the vertical and horizontal extent of soil contamination, seven soil borings were installed during the PA/SI/RI. Four of the soil borings were drilled to investigate the location of former UST 25a. Three soil borings were installed in proximity to JETS.

Groundwater and soil samples collected during RIs indicate that the soils and groundwater are contaminated with SVOCs and TPH. The estimated volume of contaminated soils is approximately 3,000 yd^3.

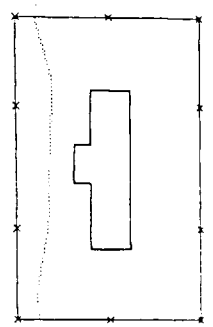
3.1.23 USTS (REMOVED)

Prior to December 22, 1988, the effective date of Federal Subtitle I regulations, 14 USTs were removed at AFP4. Twelve USTs contained petroleum and two contained hazardous substances (Hargis & Associates, Inc., 1989). Following UST removal, analyses of soil samples collected from the excavation indicated that six of the locations (USTs 19, 20, 24A, 24B, 25A, and 30) have contaminants present in the soil. No other remedial activities were performed.

FIG3143



KEYMAP



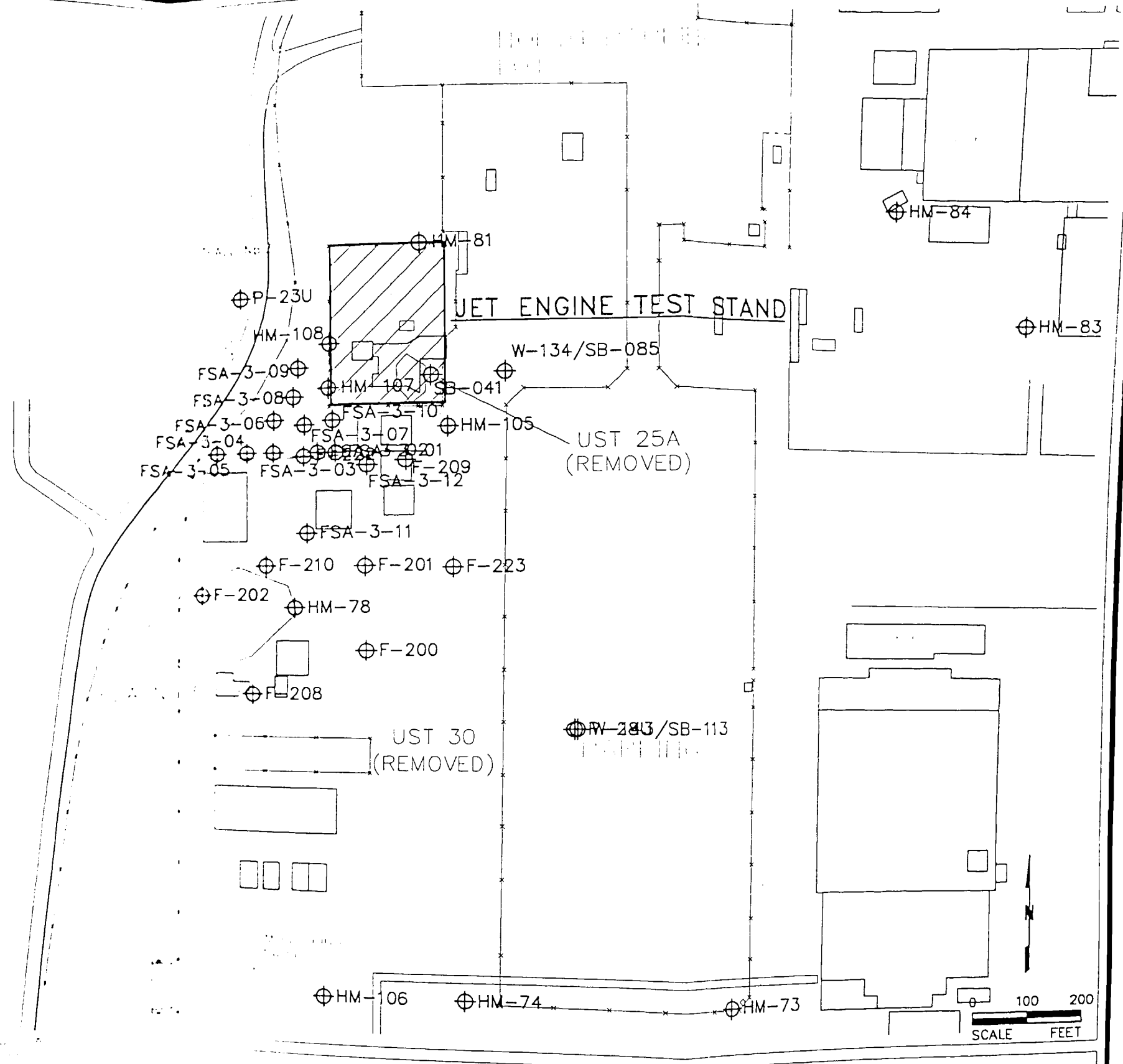


Figure 3.1-44
SAMPLE LOCATION MAP - JET ENGINE TEST STAND

SOURCE: ESE; CN GEOTECH

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A GILCORP Company

Due to the proximity of the former USTs with IRP sites, former USTs were addressed in other sections as follows:

1. USTs 19 and 20 are addressed in conjunction with FSA-1 (Section 3.1.14),
2. UST 30 is addressed in conjunction with FSA-3 (Section 3.1.16), and
3. UST 25A is addressed in conjunction with JETS (Section 3.1.22).

The former locations of USTs 24A and 24B are shown in Figure 3.1-45. The 8,000-gal USTs contained gasoline. Contaminants found in the soils during removal activities included TCE and degradation products (12DCE, vinyl chloride, etc.), toluene, and xylenes.

Four soil borings were completed during RI activities (Figure 3.1-46). Soil samples collected from the soil borings contained detectable concentrations of TPH; the maximum concentration detected was 76 mg/kg. There were no significant VOC or SVOC concentrations detected in the soil samples.

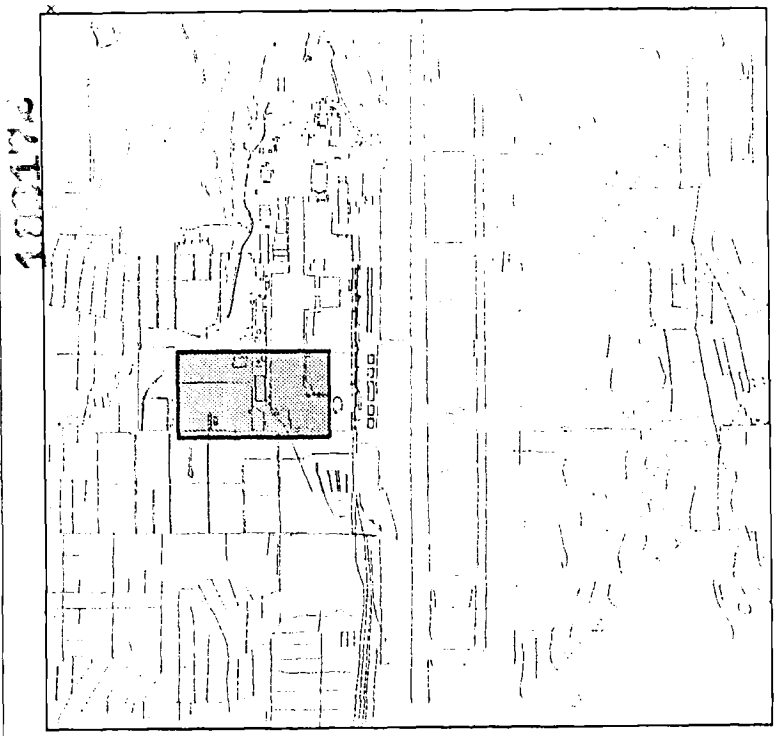
3.1.24 ASSEMBLY BUILDING/PARTS PLANT

The Assembly Building/Parts Plant is located directly north of the southern boundary of AFP4 (Figure 3.1-47). Past spills of TCE have reportably occurred within the chemical process facility of the Assembly Building/Parts Plant. The trenches, sumps, floor drains, and buried pipelines present throughout the study area are possible sources of groundwater and soil contamination.

Subsurface investigations were conducted to determine the extent of contamination present in the soils and groundwater at the Assembly Building/Parts Plant. Several soil borings and monitor wells have been installed during the following investigations:

1. Phase II Investigation of Subsurface Conditions at Plant 4, Hargis & Associates, Inc., September 1985 (1013);

FIG3145



KEYMAP

CHROME PIT No.3

UST 24A & 24B

CHROME PIT No.2

DIE YARD CHEMICAL PITS

FORMER FUEL STORAGE AREA

WASTEWATER COLLECTION BASINS

FDTA No.5

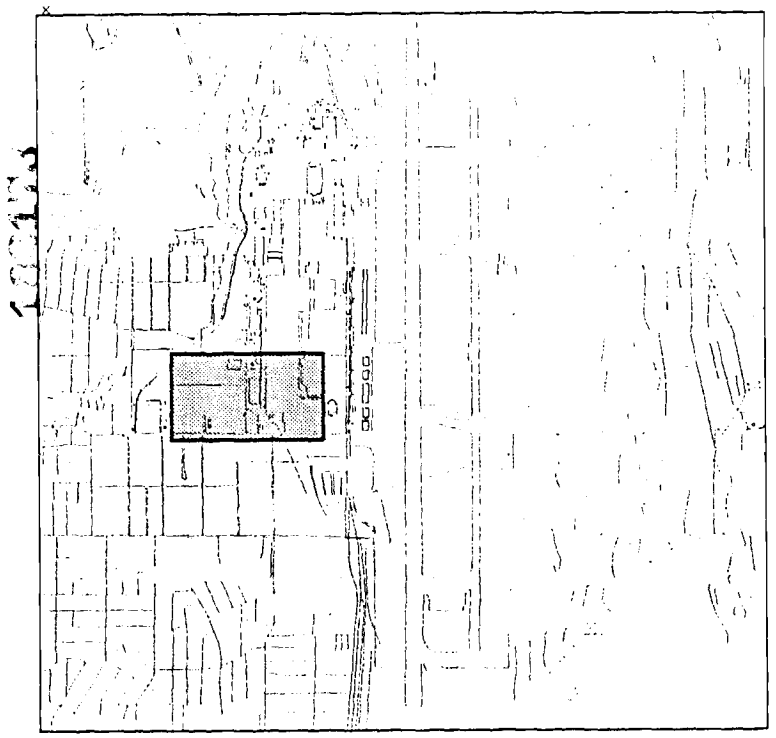
0 100 200
SCALE FEET

Figure 3.1-45
SITE MAP - UNDERGROUND STORAGE TANKS 24A & 24B

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

FIG3145



KEYMAP

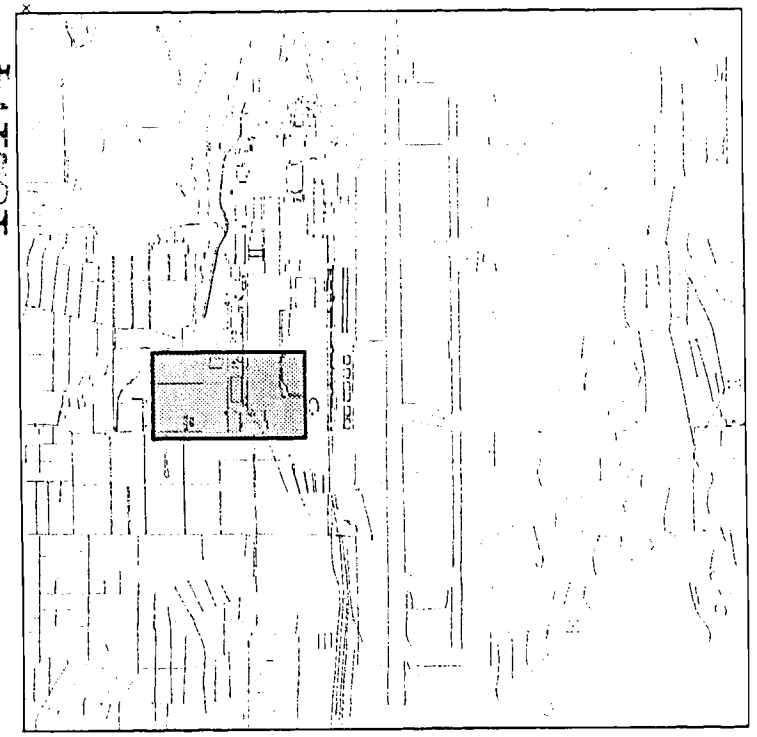
HM-45
HM-52
SB-055
HM-88
W-145
SB-054
F-219
UST 24A & 24B
0 100 200
SCALE FEET
HM-16
SB-046
W-150L/SB-134
W-150U
HM-48
F-220
HM-30
HM-1
SB-047
HM-17
F-218
W-158/SB-152
CHROME PIT No.3
W-154/SB-141
W-159/SB-153
HM-103
HM-70
SB-053
HM-15
SB-048
HM-60
HM-100
SB-074
HM-8
HM-32
CHROME PIT No.2
HM-28
SB-009
SB-049
SB-057
HM-77
W-137/SB-110
P-2
HM-47
W-160/SB-154
DIE YARD CHEMICAL PITS
SB-011
SB-066
HM-69
HM-3B
SB-058
W-133L/SB-078
HM-3A
SB-067
SB-007
W-133U/SB-067
HM-24
SB-065
HM-25
SB-010
W-151U/SB-065
HM-4A
SB-059
SB-064
HM-4B
F-221
SB-006
SB-052
P-26M
HM-104
P-12UN
HM-11
P-1
P-26U
HM-31
P-12US
P-12M
HM-14
HM-13
HM-12
P-31U
P-30M
SB-045
S-157/SB-151
FDTA No.5
FORMER FUEL STORAGE AREA
WASTEWATER COLLECTION BASINS

Figure 3.1-46
SAMPLE LOCATION MAP - UNDERGROUND STORAGE TANKS 24A & 24B

SOURCE: ESE, CN GEOTECH

Environmental Science & Engineering, Inc.
A CILCORP Company

FIG3147



KEYMAP

CHROME PIT No.3

CHROME PIT No.1

ASSEMBLY BLDG/PARTS PLANT

CHROME
PIT No.2

FORMER
FUEL STORAGE
AREA

DIE YARD
CHEMICAL PITS

FDTA No.5

WASTEWATER
COLLECTION
BASINS

0 100 200
SCALE FEET

Figure 3.1-47
SITE MAP - ASSEMBLY BUILDING/PARTS PLANT

SOURCE: ESE, CN GEOTECH

Environmental
Science &
Engineering, Inc.

2. Ten-Site Field Investigation, Plant 4, Intellus Corporation, November 1986 (1026);
3. IRP Phase II Confirmation/Quantification Stage I, Radian Corporation, December 1987 (1041);
4. Summary of Interim Remedial Investigations, January 1987 to April 1989, Hargis & Associates, Inc., July 1989 (3010); and
5. Preliminary Assessment/Site Inspection and Remedial Investigation, Geotech, December 1992 (X07).

Summaries of these reports are included in Appendix A. Reports containing specific information pertaining to the Assembly Building/Parts Plant are listed in Table 3.1-1.

To determine hydrogeologic properties and groundwater quality in the upper zone flow system in the Assembly Building/Parts Plants, the following monitor wells were installed:

1. Wells HM-31, HM-48, HM-52, HM-55, HM-56, HM-57, HM-58, HM-59, HM-64, HM-69, and HM-70 (installed during the Phase II investigation activities);
2. Wells F-218 and F-219 (installed during the ten-site investigation activities); and
3. Wells HM-102 and HM-103 (installed during the IRP Phase II investigation activities).

To determine hydrogeologic properties and groundwater quality in the Paluxy Formation in the Assembly Building/Parts Plant, the following monitor wells were installed:

1. Wells P-5u, P-5m, P-6u, P-6m, P-9u, P-9m, P-12u, and P-12m (installed during the Phase II investigation activities); and
2. Wells P-5un, P-5us, P-9un, P-9us, P-12us and P-12un (installed during the summary of interim remedial investigations activities).

Soil boring and monitor well locations are shown on Figure 3.1-48. Lithologic logs for monitor wells are included in Appendix C.

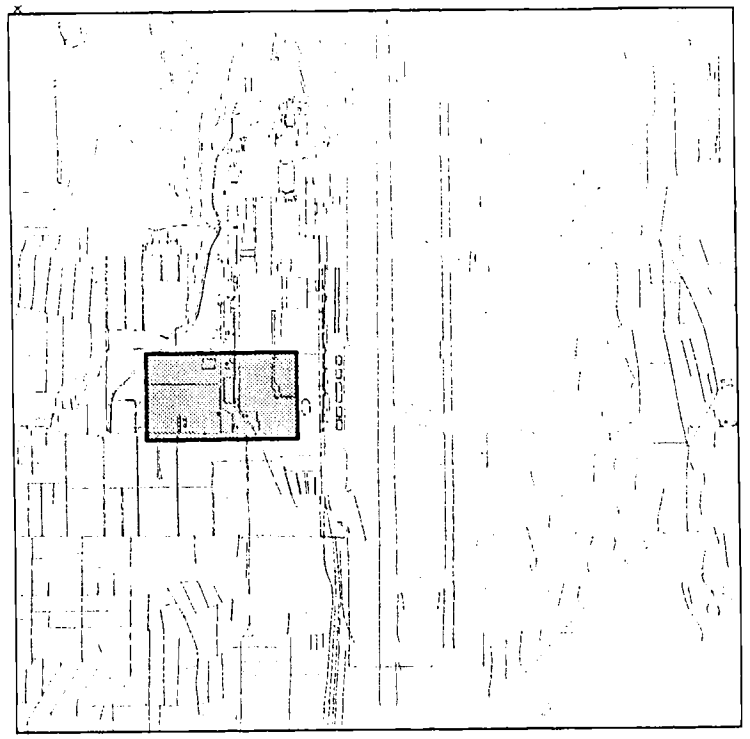
Numerous Upper Zone monitor wells and Paluxy Formation monitor wells were installed by Hargis & Associates, Inc. to define the lateral and vertical extent of contamination in the area surrounding the Assembly Building/Parts Plant. USACE installed Well P-12 on the south side of General Warehouse Building No. 118. Groundwater samples collected from this well contained oil and grease and TCE.

The two monitor wells installed by Intellus (Wells F-218 and F-219) on the south side of the Assembly Building/Parts Plant were designed to locate Chrome Pit No. 1. Soil and groundwater samples contained no contaminants, and the location of Chrome Pit No. 1 was not confirmed. The soil samples collected from shallow soil borings drilled by Intellus near the southwest corner of Process Building No. 181 in the vicinity of Chrome Pit No. 2 contained no contaminants.

Soil samples collected during the installation of Wells HM-103 and HM-104, during the IRP Phase II investigation, contained TCE. Groundwater samples collected from the monitor wells contained VOCs. Hargis & Associates, Inc. installed Wells P-5us, P-5un, P-9us, P-9un, P-12us, and P-12un to determine the vertical extent of contamination in the Paluxy Formation.

A soil gas survey and soil borings were completed during the RI. The soil gas survey was used as an initial screening study prior to the collection of soil samples. The soil gas survey was conducted around the entire perimeter of the Assembly Building/Parts Plant to locate possible areas of contamination. Thirty-five soil borings were installed to determine the vertical and horizontal extent of soil contamination.

FIG3147



KEYMAP

HM-45
HM-52
SB-055
HM-88
W-145
SB-054
F-219
0 100 200
SCALE FEET
HM-16
W-150L/SB-134
W-150U
P-220
HM-30
HM-1
HM-17
W-154/SB-141
CHROME PIT NO.3
SB-046
HM-48
SB-047
F-218
CHROME PIT NO.1
W-158/SB-152
W-159/SB-153
HM-103
HM-70
SB-053
HM-15
SB-048
HM-60
ASSEMBLY BLDG/PARTS PLANT
HM-100
SB-074
HM-8
HM-32
HM-28
SB-009
CHROME PIT No.2
SB-049
P-2
SB-057
HM-77
W-137/SB-110
W-160/SB-154
HM-69
FORMER FUEL STORAGE AREA
DIE YARD CHEMICAL PITS
SB-011
SB-058
SB-066
HM-47
WASTEWATER COLLECTION BASINS
HM-3B
SB-058
W-133L/SB-078
HM-3A
SB-067
SB-007
W-133U/SB-067
HM-24
SB-010
SB-065
HM-4A
SB-059
SB-064
HM-4B
P-221
SB-006
SB-052
P-26M
HM-104
P-12UN
HM-14
HM-13
HM-12
P-31U
HM-11
P-1
P-26U
HM-31
P-12US
P-12M
P-30M
SB-045
S-157/SB-151

Figure 3.1-48
SAMPLE LOCATION MAP - ASSEMBLY BUILDING/PARTS PLANT

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A CECORP Company

Soil contamination consisting of solvents was detected in soil samples collected east of Facidlities Building No. 12. Contamination occurs in the vadose zone, since groundwater was not encountered, and decreases with depth suggesting source spills or shallow uses. Relatively low concentrations of TCE (7 to 220 μg/kg) occur in saturated soils under most of the south end of the Assembly Building/Parts Plant and extend east at least as far as Runway No. 130 North. The extent of VOC contamination in the soil coincided roughly with the axis of the paleochannel. Several SVOCs were detected in two of the soil samples. Small degrees of localized SVOC contamination suggest that one probable source may be asphalt paving that was collected with the soil samples.

Groundwater samples collected from the upper zone monitor wells contained concentrations of VOCs (primarily TCE) exceeding MCL guidelines. Paluxy monitor well suite 9 and 12 contained concentrations of TCE and other VOCs exceeding MCL guidelines.

A soil vacuum extraction pilot system was put into operation in December 1993. The vacuum system consists of 7 extraction wells and 2,000- to 3,000-lb carbon absorbers to treat emissions. The system is expected to be in operation until April 1994. The pilot study report will be submitted 14 days after the field test is complete.

3.1.25 SURFACE WATER QUALITY

The results of surface water samples collected during the RI activities are addressed in this section. Surface water samples were collected from the following surface water bodies:

1. Meandering Road Creek,
2. Lake Worth, and
3. Farmer's Branch.

Surface water sampling locations are shown on Figure 3.1-49. The analytical results suggest that Upper Zone groundwater at the site is hydrologically connected to various surface water bodies.

3.1.25.1 Meandering Road Creek

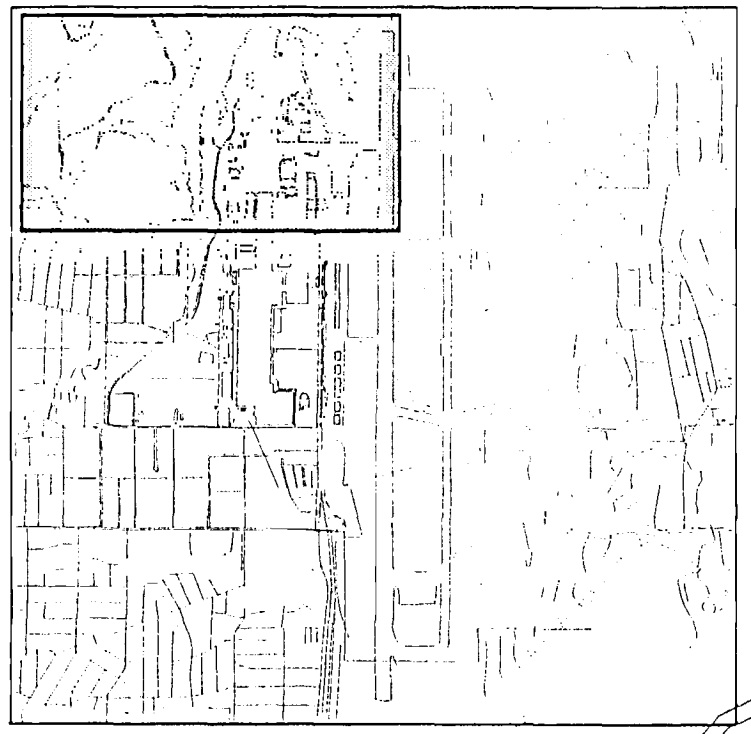
Forty-three surface water samples have been collected from Meandering Road Creek; 40 samples directly from the creek and 3 samples from the seep located on the east margin of the stream near the boundary of LF03 (Geotech, 1992). Surface water samples collected from Meandering Road Creek contained VOCs (primarily TCE and TCE degradation products), and negligible concentrations of SVOCs, TPH and oil and grease. The highest concentration of VOCs is located at LF03. The suspect source of surface water contamination is the upper zone flow system groundwater.

3.1.25.2 Lake Worth

Nine surface water samples were collected from Lake Worth. The surface water samples were analyzed for VOCs, SVOCs, TPH, oil and grease, and metals. Only two contaminants (carbon disulfide and oil and grease) were detected in the samples. The extent and degree of carbon disulfide contamination indicated that the carbon disulfide did not originate from a common source (Geotech, 1992). Oil and grease was detected at a negligible amount from one surface water location.

Seeps SW-10 and SW-11 and Outfall No. 3, located up-slope from Lake Worth, were sampled during this RI. The surface water samples from the seeps and outfall contained concentrations of metals. The source of the metals contamination found in the seeps and outfall is most likely the upper zone groundwater.

FIG3149



KEYMAP

Figure 3.1-49
SURFACE SAMPLE COLLECTION LOCATIONS

SOURCE: ESE; CN GEOTECH

Environmental Science & Engineering, Inc.
A GILDORP Company

3.1.25.3 Farmer's Branch

Surface water samples were collected from Farmer's Branch near the outlet of the aqueduct that conveys water under the runway at CAFB. Surface water samples were analyzed for metals and VOCs. The samples contained no VOCs; metals concentrations were below MCLs.

3.2 SUMMARY OF CAFB ASSESSMENT PROJECTS

During the Phase I records search, CH2M Hill identified 17 disposal and spill sites (designated IRP sites) at CAFB and 5 sites at the Weapons Storage Area. Several of these sites were determined not to have significant potential for adverse environmental effects. The potential environmental consequences of the remaining 14 sites were evaluated using the USAF HARM. This evaluation took into account such factors as potential receptors of contamination, the nature of the waste, potential pathways for contaminant migration, and efforts to contain potential contamination. The IRP sites are as follows:

1. Site #1 - LF01,
2. Site #3 - LF03,
3. Site #4 - LF04,
4. Site #5 - LF05,
5. Site #10 - Waste Burial Area,
6. Site #11 - FDTA 1,
7. Site #12 - FDTA 2,
8. Site #13 - Flightline Drainage Ditch,
9. Site #15 - Entomology Dry Well,
10. Site #16 - Unnamed Stream,
11. Site #17 - POL Tank Farm,
12. Site #WSA-1 - Weapons Storage Area, and
13. BSS

The BSS was not designated as an IRP site until completion of the Stage 1 investigation. Sites 1, 13, 15, 16, and 17 were informally grouped as one into

the East Area, and the remaining sites were grouped into the Flightline Area. The locations of each of the CAFB IRP sites are depicted in Figure 3.2-1. The following sections are organized to present a brief description of the IRP site and a summary of the assessment reports that have been completed to date.

3.2.1 SITE NO. 1 - LF01

LF01 was reportedly the original CAFB landfill and was operated during the 1940s, but is no longer in use. It was located adjacent to the Trinity River levee at the site currently occupied by the DRMO storage yard (Figure 3.2-2). Due to the time elapsed since this site was closed, no information was available concerning past waste disposal practices at this location.

The subsurface investigation at LF01 was performed during three separate investigations and included the installation of six monitor wells to determine the quality of the groundwater in the Upper Zone. Monitor well 1A is the background well, and is located in the southeast corner of the park bordering the DRMO (Figure 3.2-3). Wells 1B and 1C are located inside the DRMO yard; wells 1E and 1F are located east of the DRMO yard. All the wells are screened within the Upper Zone.

The studies have shown that the groundwater at LF01 contains elevated levels of oil and grease, heavy metals, and some purgeable halocarbons. The groundwater moves east toward the Trinity River, located adjacent to the site.

The remediation efforts to date have resulted in the removal of approximately 11,000 yd^3 of contaminated soil. Two french drains were installed to collect leachate from the site.

Four reports are considered to contain pertinent information regarding the investigations at LF01. These reports are as follows:

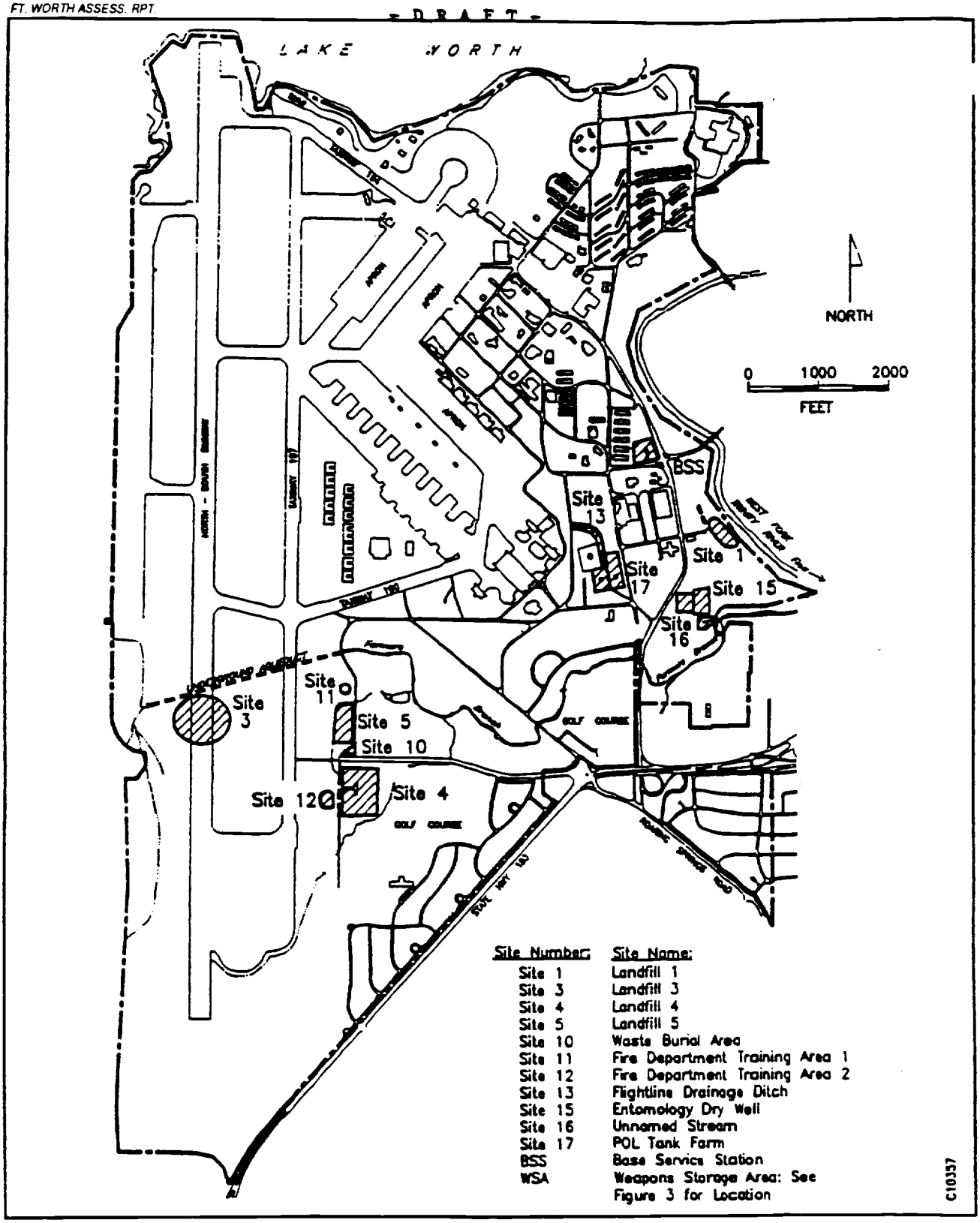


Figure 3.2-1
LOCATION OF IRP SITES AT CAFB, TEXAS

SOURCE: RADIAN, 1989; ESE.

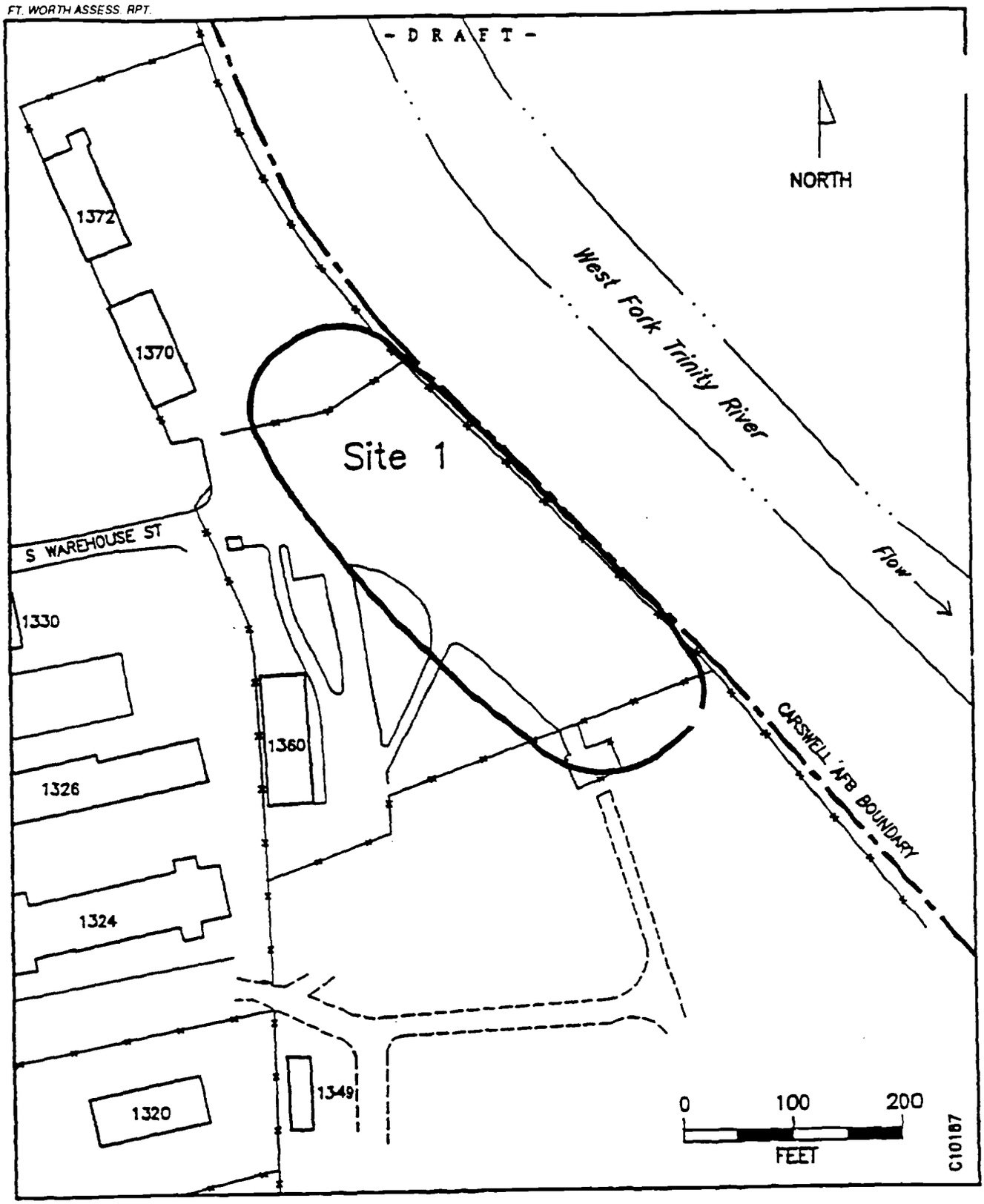


Figure 3.2-2
SITE MAP--SITE #1 (LF01)

SOURCE: RADIAN, 1989; ESE.

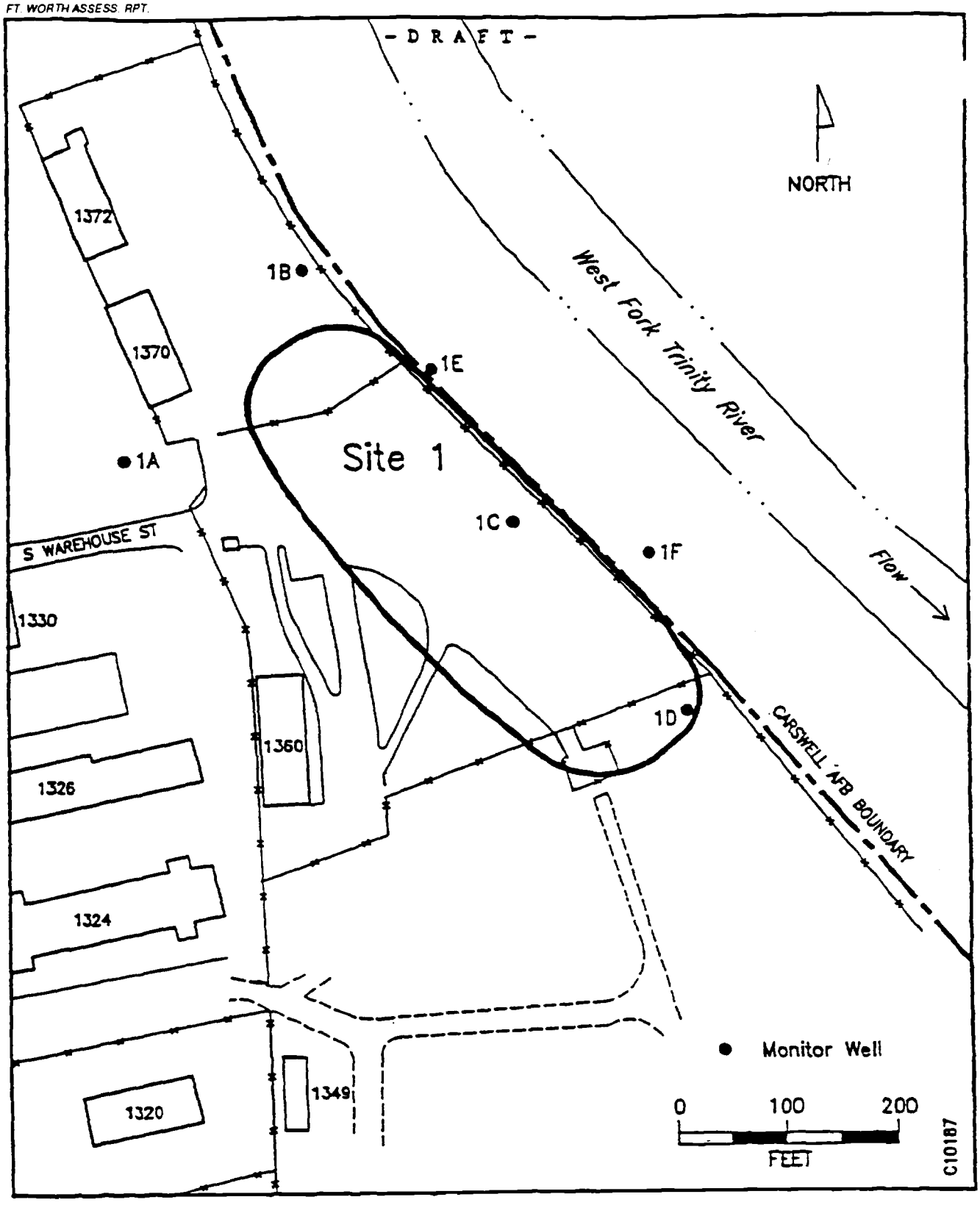


Figure 3.2-3
SAMPLING LOCATIONS–LF01

SOURCE: RADIAN, 1989; ESE.

1. Radian Corporation, 1986, Phase II Confirmation/Quantification, Stage 1 Investigation (CAFB-83)
2. Radian Corporation, 1988, Phase II Confirmation/Quantification, Stage 2 Investigation (CAFB-1)
3. Radian Corporation, 1989, RI/FS, Stage 2 Investigation (CAFB-NA1)
4. Radian Corporation, 1991, RI/FS - East Area (CAFB-101/75)

These reports are summarized and included in Appendix B. A listing of the reports that contain specific information regarding LF01 is shown in Table 3.2-1.

3.2.2 SITE NO. 3 - LF03

LF01 is located under the area currently occupied by the CAFB runway, immediately south of the culvert which carries Farmers Branch (Figure 3.2-4). LF03 was in operation from 1950 to 1952. During this period, the runway ended north of Farmers Branch, and the wastes were placed in a ravine. The site was used as a disposal point for all types of waste but was primarily used for construction rubble.

The subsurface investigation at LF03 was performed during Stage 1 of the Phase II investigations and included the installation of four boreholes and one monitor well (Figure 3.2-5). The four borings were progressed to the upper surface of the Goodland Formation, situated from 20 to 30 ft-bls. Soil samples were collected from these borings for laboratory analyses. Monitor well 3D was completed within the surficial deposits to test the quality of the Upper Zone at the site.

Data obtained during the Stage 2 investigation provided evidence that no hazardous waste or waste constituents have been released into the subsurface at LF03. Therefore, it was concluded that this site did not pose a threat to the

Table 3-2.1. Summary of Remedial Assessment Reports, CAFB, Fort Worth, Texas (Page 1 of 2)

Project	IRP Sites												
	#1	#3	#4	#5	#10	#11	#12	#13	#15	#16	#17	WSA	BSS
IRP Phase I Records Search, CH2M Hill, 1984 (CAFB-86)	X	X	X	X	X	X	X	X	X	X	X	X	
Phase II, Stage 1 Report, Radian Corporation, 1986 (CAFB-83)	X	X	X	X	X	X	X	X	X	X	X		X
RI/FS Stage 2 Report, Radian Corporation, 1989 (CAFB-83)	X	X	X	X	X	X	X	X	X	X	X	X	X
Phase II, Stage 2 Report, East Area, Radian Corporation, 1991 (CAFB-65)	X							X	X	X	X		
Phase II, Stage 2 Report, Flight Line Area, Radian Corporation, 1991 (CAFB-74)		X	X	X	X	X	X						
Phase II, Stage 1 Report, Weapons Storage Area, Radian Corporation, 1988 (CAFB-66)												X	
RCRA Permit-Investigation/ Remediation Plans, USACE, 1991 (CAFB-68)			X	X	X	X	X						
RCRA Assessment-PR/VSI Report, A.T. Kearney, 1989 (CAFB-81)			X	X	X	X	X						
Soil Gas Survey Results, Target Environmental Services, 1993 (CAFB-X7)													X
Preliminary Radium Assessment-Weapons Storage Area, USACE, 1992 (CAFB-X4)												X	

Table 3-2.1. Summary of Remedial Assessment Reports, CAFB, Fort Worth, Texas (Page 2 of 2)

Project	IRP Sites												
	#1	#3	#4	#5	#10	#11	#12	#13	#15	#16	#17	WSA	BSS
Investigation of Groundwater Pollution, USACE, 1986 (CAFB-X3)	X	X	X	X	X	X	X	X	X	X	X	X	
Community Relations Plan, USACE, 1993 (CAFB-X4)													
Environmental Impact Statement, Carswell Redevelopment Authority, 1993 (CAFB-X8)													
Removal of Buried Drums-SWMU 24 (IRP #10), USACE (CAFB-X11)					X								
Contamination Assessment-Waste Oil Dump, USACE, 1993 (CAFB-X9)													
Contamination Assessment-Landfill 6, USACE, 1993 (CAFB-X10)													
Contamination Assessment-Spot 35, USACE, 1992 (CAFB-X6)													
Contamination Assessment-White House Communications Building 1337, Maxim Engineers, 1990 (CAFB-80)													

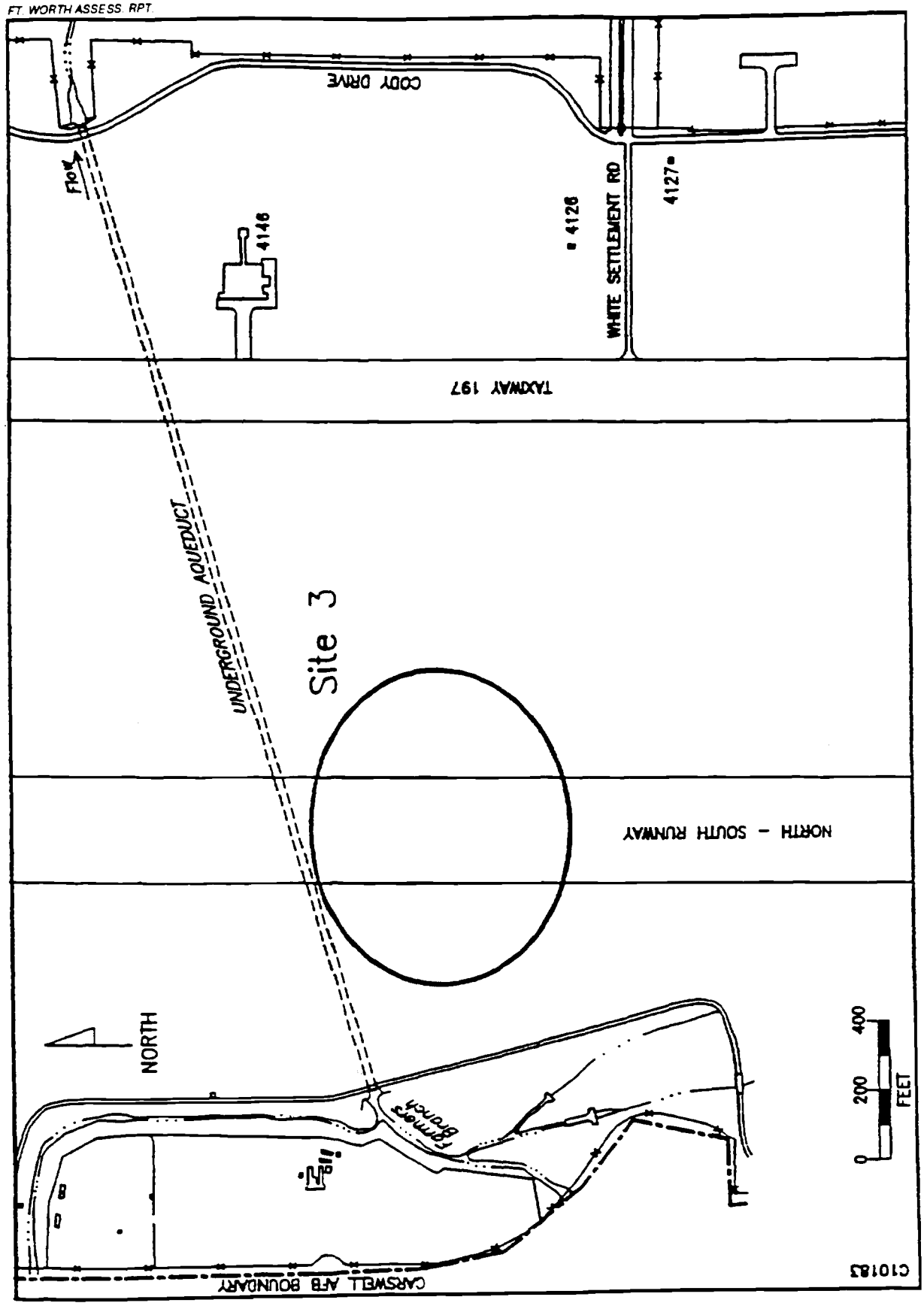


Figure 3.2-4
SITE MAP--SITE #3 (LF03)

SOURCE: RADIAN, 1989; ESE.

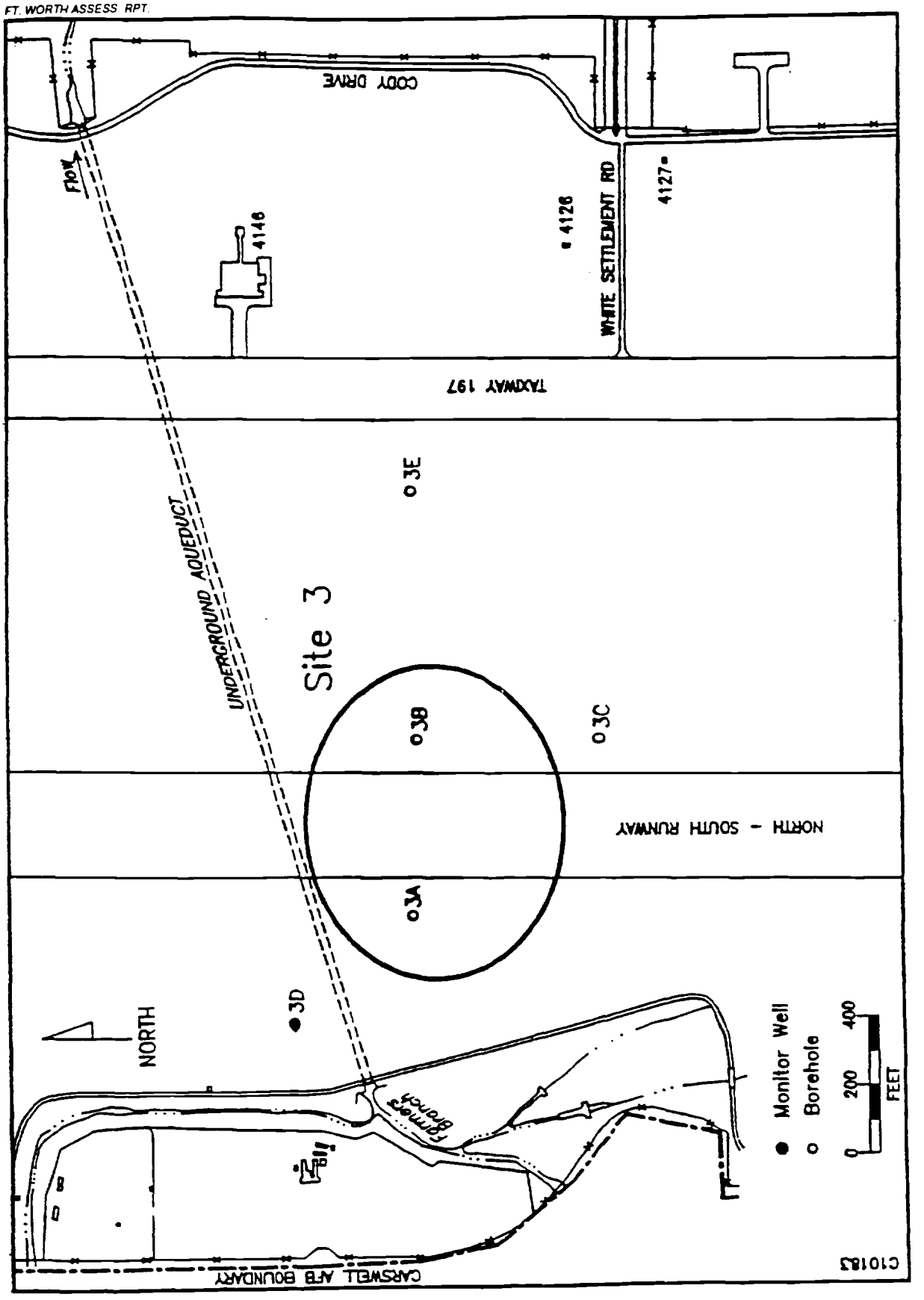


Figure 3.2-5
SAMPLING LOCATIONS--LFO3

SOURCE: RADIAN, 1989; ESE.

environment or to human health and a Decision Summary Technical Document to Support No Further Action was prepared.

The only document considered pertinent regarding investigations at LF03 is as follows:

> Radian Corporation, 1986, Phase II Confirmation/Quantification, Stage 1 Investigation (CAFB-83).

A summary of this report is provided in Appendix B. A listing of the reports containing specific information about LF03 is shown in Table 3.2-1.

3.2.3 SITE NO. 4 - LF04

LF04 encompasses approximately 10 acres of land east of the runway near the current location of the radar site (Figure 3.2-6). This landfill was the primary disposal location for CAFB from 1956 to 1975. All CAFB refuse was buried here and burning was a common treatment practice. At least six large pits, approximately 12 ft deep, were filled during the history of the landfill. Hazardous materials are suspected to be buried at LF04, including drums of waste liquids, paint cans, and cadmium batteries. Records indicate that waste paints, thinners, strippers, solvents, and oils were commonly placed in the landfill.

The subsurface investigation at LF04 was performed during three separate investigations and included the installation of 12 monitor wells (Figure 3.2-7). Monitor wells 4A and 4B were installed south of the site. Wells 4C, 4D, 4E, 4H, and P-2 were installed east of the site; and well 4F was installed north o the site. Monitor well P-2 is completed within the Paluxy aquifer and the remaining wells are completed within the Upper Zone. Soil and groundwater have been collected from these well locations for laboratory analyses.

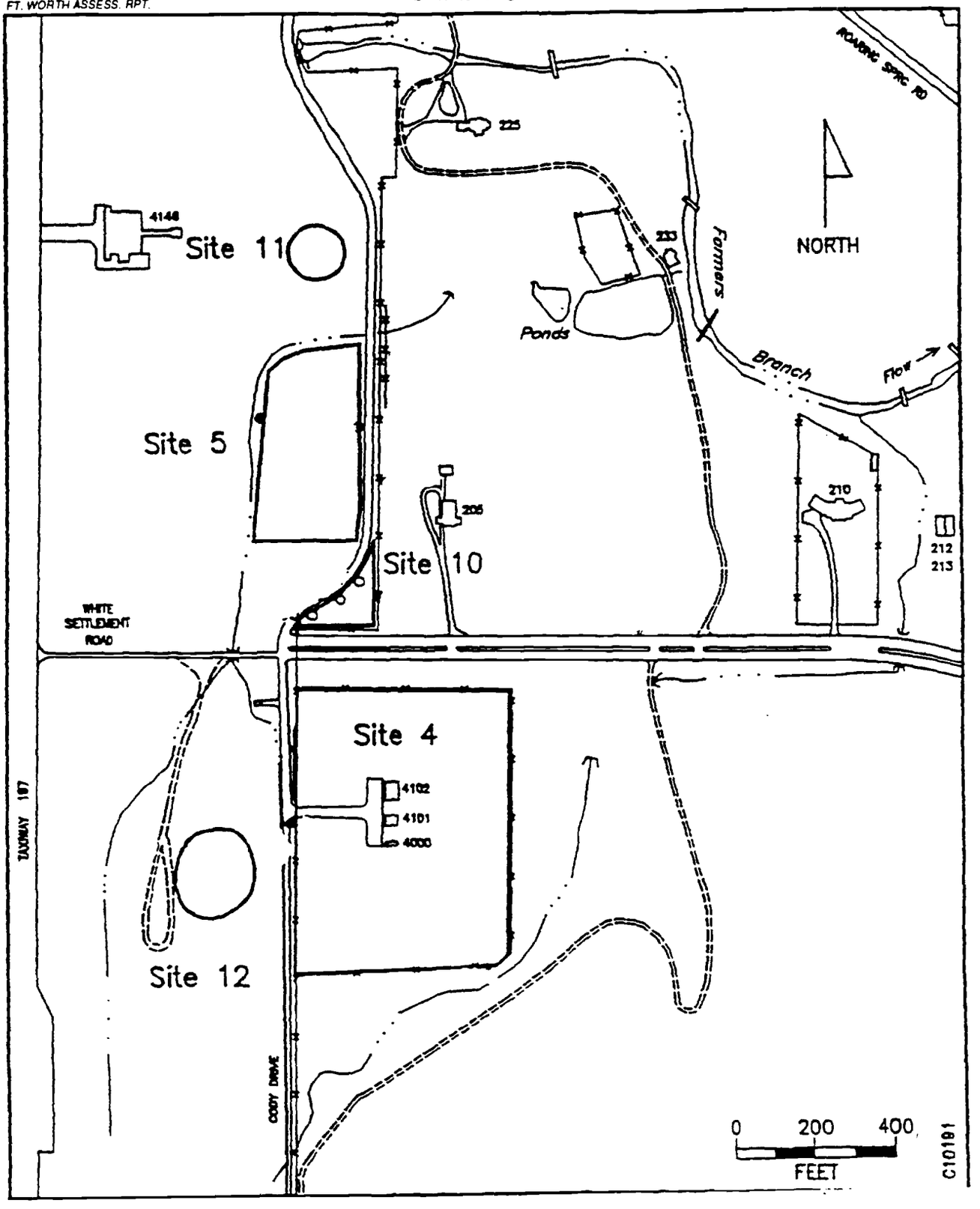


Figure 3.2-6
SITE MAP–SITE #4 (LF04)

SOURCE: RADIAN, 1989; ESE.

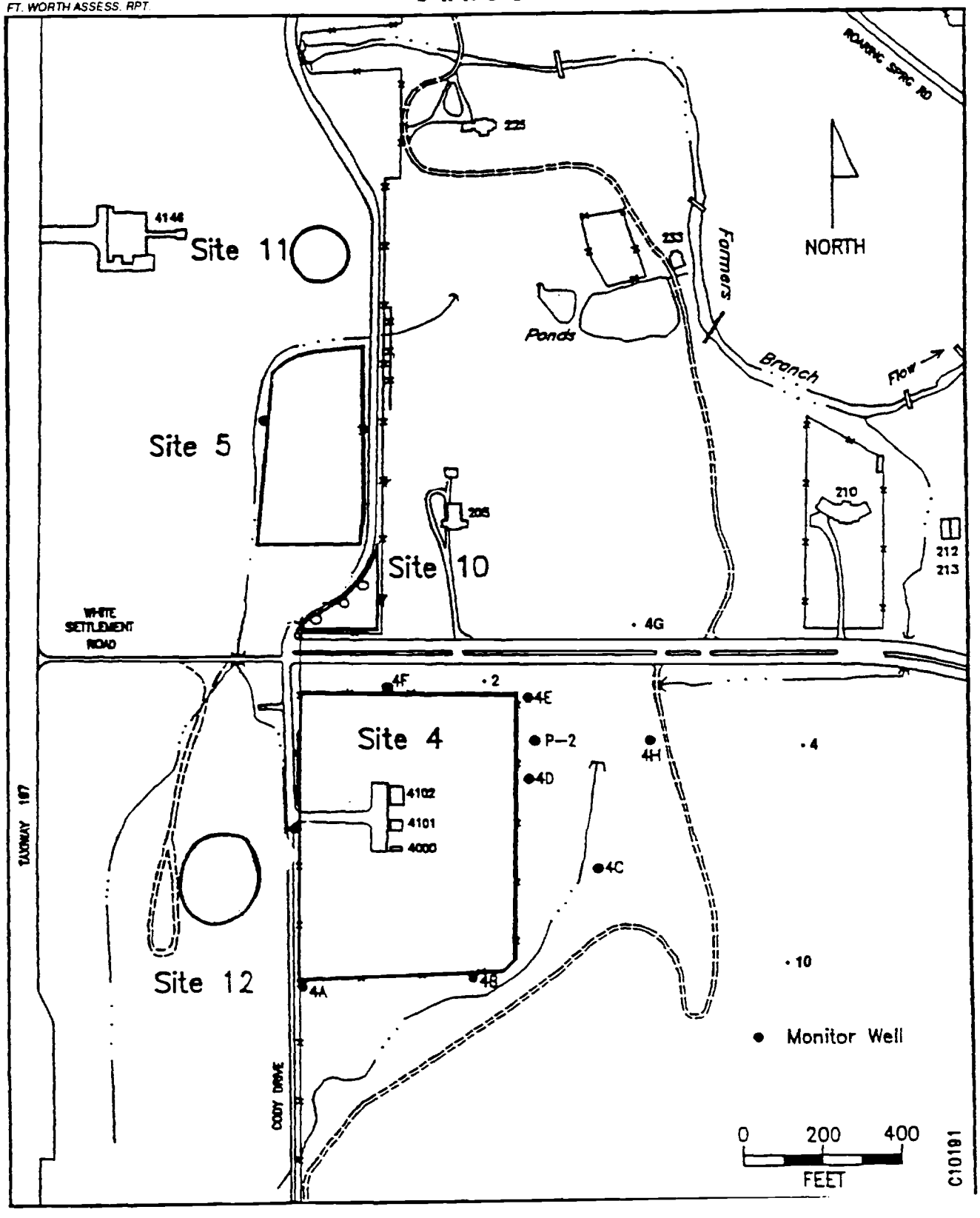


Figure 3.2-7
SAMPLING LOCATIONS--LF04

SOURCE: RADIAN, 1989; ESE.

Results of the investigations indicated that groundwater beneath LF04 was found to contain elevated levels of TCE. The occurrence of TCE was measured in concentrations of up to 5,000 μg/L in the Upper Zone aquifer in both the upgradient and downgradient directions of the landfill. The groundwater within the Upper Zone flows east-southeast beneath the site. The groundwater within the Paluxy aquifer was found to be unaffected.

An RI was also performed in 1993 which included the installation of recovery wells as part of a remediation system.

Five reports are considered to contain pertinent information regarding investigations at Landfill 4. These reports are as follows:

1. Radian Corporation, 1986, Phase II Confirmation/ Quantification, Stage 1 Investigation (CAFB-83);
2. Radian Corporation, 1988, Phase II Confirmation/ Quantification, Stage 2 Investigation (CAFB-1);
3. Radian Corporation, 1989, RI/FS, Stage 2 Investigation (CAFB-NA1);
4. Radian Corporation, 1991, RI/FS - Flightline Area (CAFB-76/74); and
5. International Technology Corporation, 1993, RI, Landfill No. 4 and 5 (CAFB-X31).

A summary of each of these reports is provided in Appendix B. A listing of the reports containing specific information about LF04 is shown in Table 3.2-1.

3.2.4 SITE NO. 5 - LF05

LF05 is located immediately northwest of Landfill 4, adjacent to a tributary to Farmers Branch (Figure 3.2-8). The landfill was used between 1963 and 1975 and was constructed by building a clay berm adjacent to the creek and filling the

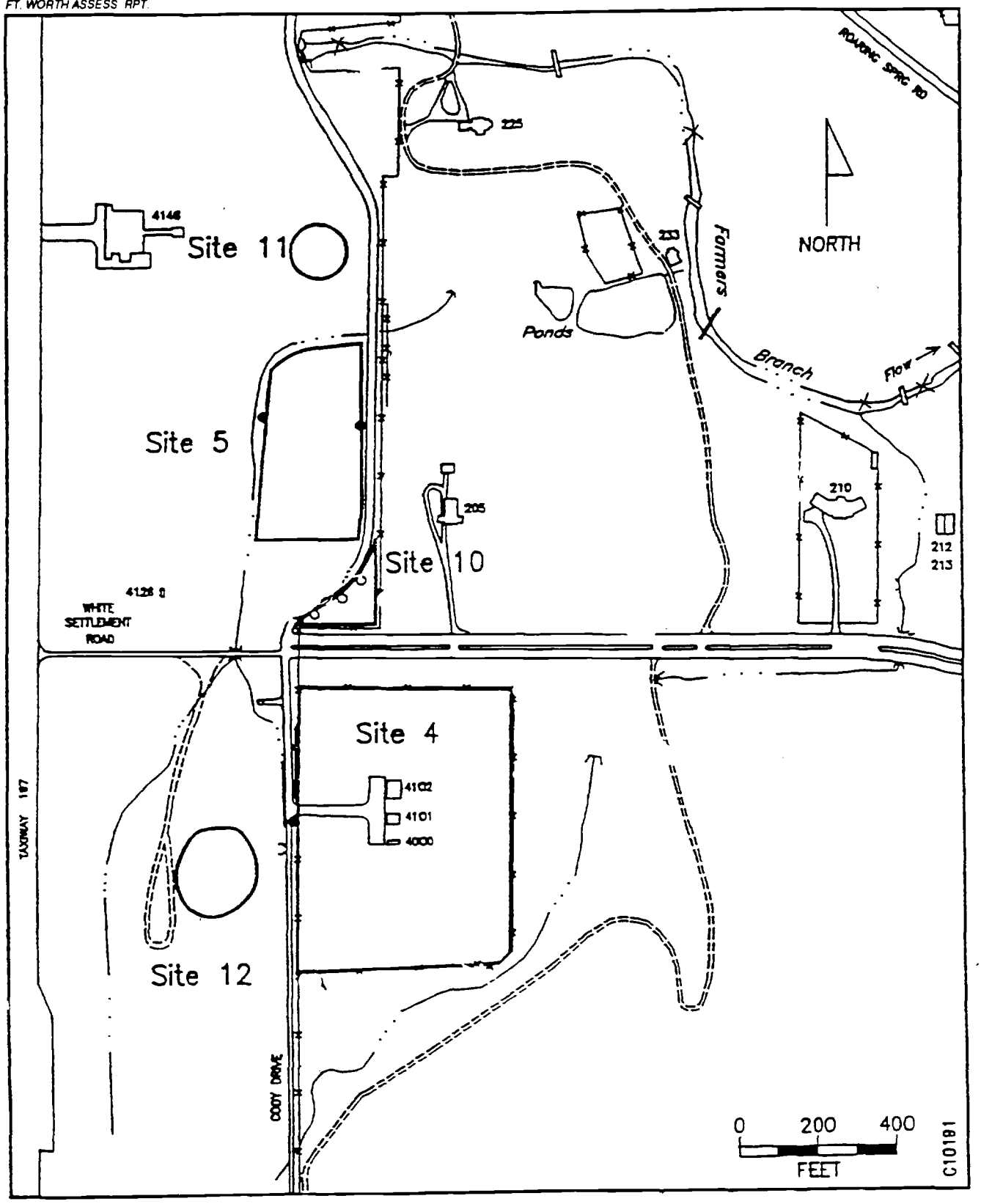


Figure 3.2-8
SITE MAP--SITE #5 (LF05)

SOURCE: RADIAN, 1989; ESE.

area behind the berm to its present level. LF05 was reportedly the disposal site for all types of wastes which were burned prior to coverage.

The subsurface investigation at LF05 was performed during three separate investigations and included the installation of 14 monitor wells at the locations shown in Figure 3.2-9. Monitor well P-1 was completed within the Paluxy aquifer and the remaining wells are completed within the Upper Zone. Both soil and groundwater samples have been collected from these well locations for laboratory analyses. Seven surface water samples (S-1 through S-7) were also collected from Farmers Branch downgradient of the landfill.

Results of the investigations indicated that, as with LF04, the groundwater beneath LF05 was found to contain elevated levels of TCE in the Upper Zone aquifer. The groundwater within the Upper Zone flows east-southeast beneath the site.

An RI was also performed in 1993 which included the installation of recovery wells as part of a remediation system.

Five reports are considered to contain pertinent information regarding the investigations at LF05. These reports are as follows:

1. Radian Corporation, 1986, Phase II Confirmation/Quantification, Stage 1 Investigation (CAFB-83);
2. Radian Corporation, 1988, Phase II Confirmation/Quantification, Stage 2 Investigation (CAFB-1);
3. Radian Corporation, 1989, RI/FS, Stage 2 Investigation (CAFB-NA1);
4. Radian Corporation, 1991, RI/FS - Flightline Area (CAFB-76/74); and
5. International Technology Corporation, 1993, RI, Landfill No. 4 and 5 (CAFB-X31).

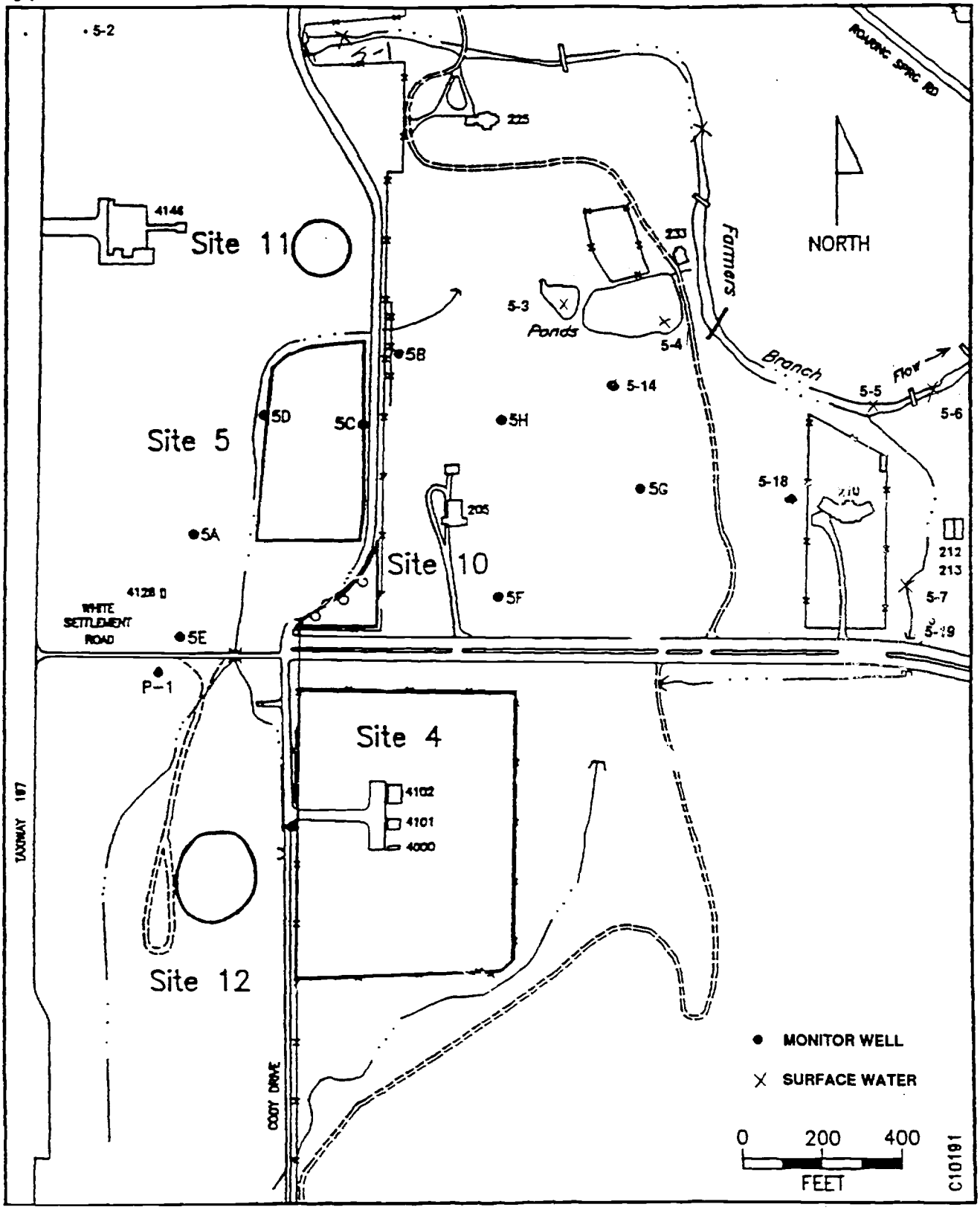


Figure 3.2-9
SAMPLING LOCATIONS–LF05

SOURCE: RADIAN, 1989; ESE.

A summary of each of these reports is provided in Appendix B. A listing of the reports containing specific information about LF05 is shown in Table 3.2-1.

3.2.5 SITE NO. 10 - WASTE BURIAL AREA

The Waste Burial Area is located north of and adjacent to White Settlement Road, near its terminus at the taxiway (Figure 3.2-10). This site was used for burial of wastes during the 1960s. Various types of hazardous materials, including drums of cleaning solvents, leaded sludge, and possibly ordnance materials, were disposed of at this site. The base of the dump is reportedly situated within a clay layer of restricted permeability.

The subsurface investigation at Site 10 was performed during three separate investigations and included the installation of three monitor wells (Figure 3.2-11). Monitor well 10A is west of the site, well 10C is north of the site, and well 10B is located east of the site. The three borings (10D, 10E, and 10F) were installed along the western edge of the site. All six wells are completed within the Upper Zone. Both soil and groundwater have been collected from these well locations for laboratory analyses.

As the Waste Burial Area is situated between LF04 and LF05, the groundwater within the Upper Zone beneath the site exhibits the same TCE contamination as these two landfill sites. An RI was performed in 1991 that involved the removal of some buried drums and contaminated soil.

Four reports are considered to contain pertinent information regarding the investigations at Site 10. They are:

1. Radian Corporation, 1986, Phase II Confirmation/Quantification, Stage 1 Investigation (CAFB-83)
2. Radian Corporation, 1988, Phase II Confirmation/Quantification, Stage 2 Investigation (CAFB-1);

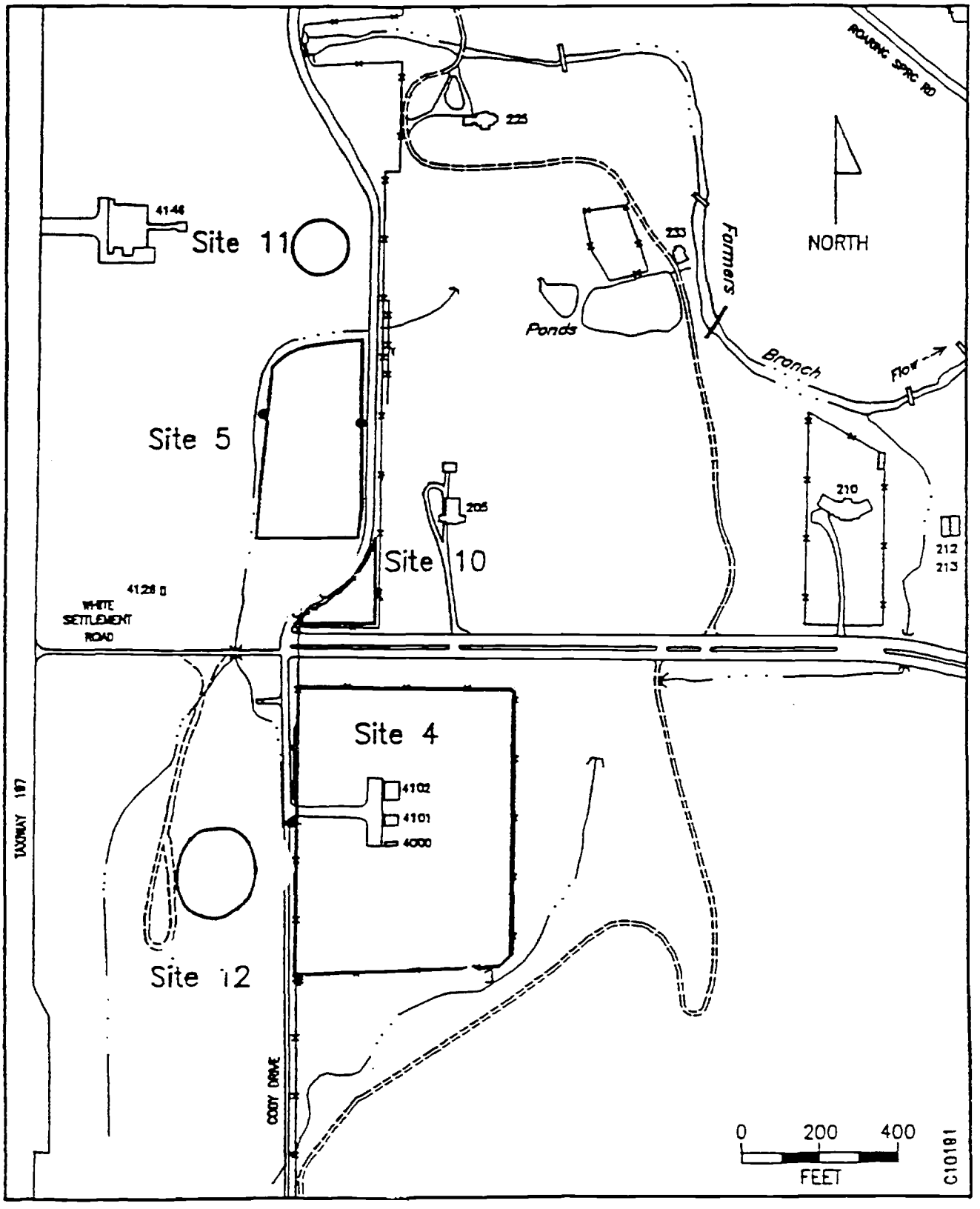


Figure 3.2-10
SITE MAP--SITE #10 (WASTE BURIAL AREA)

SOURCE: RADIAN, 1989; ESE.

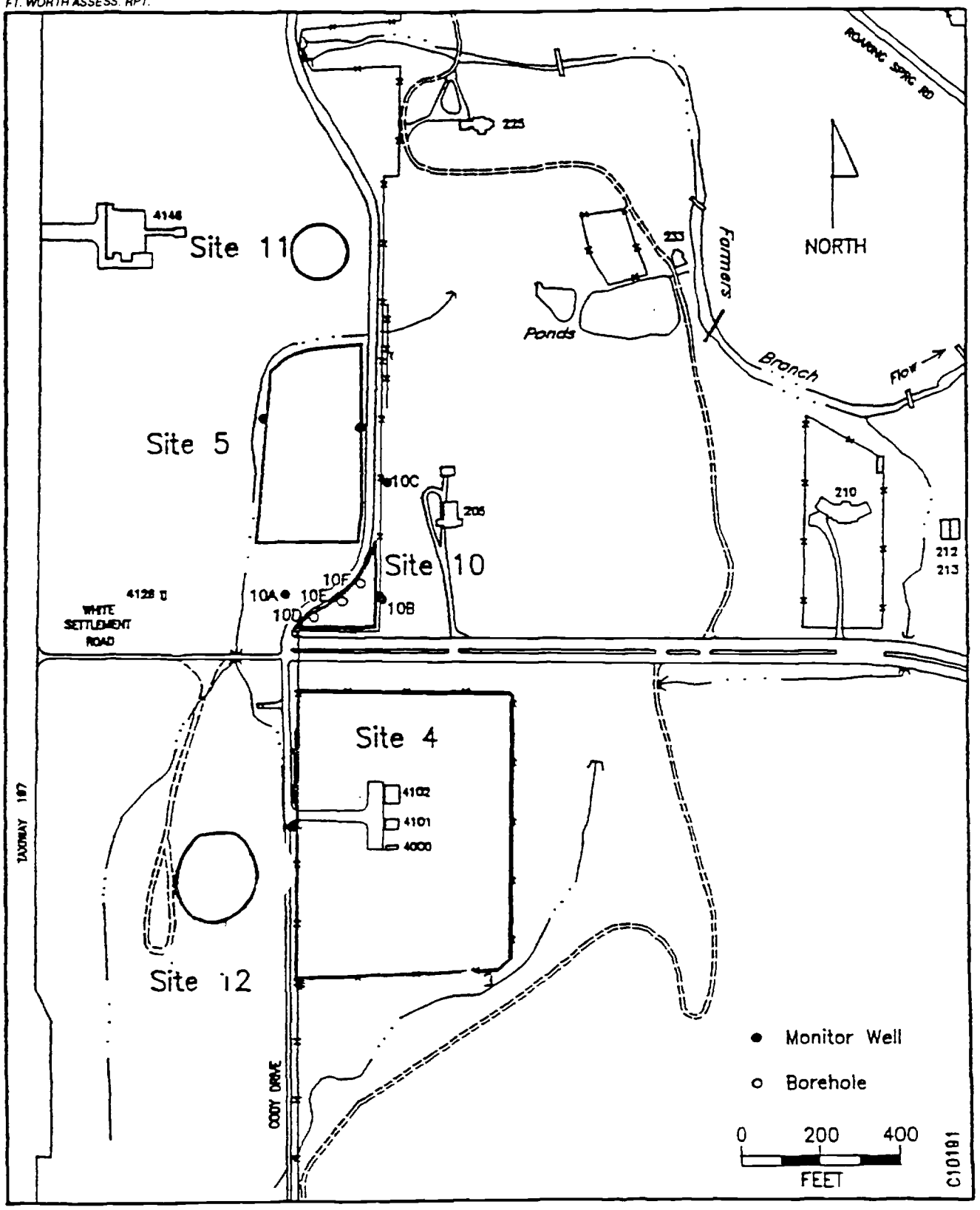


Figure 3.2-11
SAMPLING LOCATIONS--WASTE BURIAL AREA

SOURCE: RADIAN, 1989; ESE.

3. Radian Corporation, 1989, RI/FS, Stage 2 Investigation (CAFB-NA1); and
4. Radian Corporation, 1991, RI/FS - Flightline Area (CAFB-76/74).

A summary of each of these reports is provided in Appendix B. A listing of the reports containing specific information about Waste Burial Area is shown in Table 3.2-1.

3.2.6 SITE NO. 11 - FDTA 1

The FDTA 1 is located just north of Landfill 5 (Figure 3.2-12). This site was used as the primary fire training area prior to 1963. The burn pit was reportedly located adjacent to a small to tributary of the Farmers Branch. The pit was lined with gravel and had a low concrete curb built around the perimeter. The site was used for fire training exercises approximately twice per month while active. Waste oil and other flammable liquids were used in the training exercises.

The subsurface investigation at Site 11 was limited to the Phase II Stage 1 part of the IRP. During the investigation, two monitor wells were installed at the locations shown in Figure 3.2-13. Monitor well 11A was installed north of the site and well 11B was installed south of the site. Both wells are completed within the Upper Zone. Soil and groundwater have been collected from these well locations for laboratory analyses.

The results of the investigations have shown that low levels of TCE (ranging up to 0.25 μg/L) were present in the groundwater of the Upper Zone beneath the site. TCE was also found in low concentrations in the soil at the site. Groundwater within the Upper Zone flows eastward beneath the site. The groundwater acts in hydraulic exchange with the Farmers Branch. An RI has yet to be implemented.

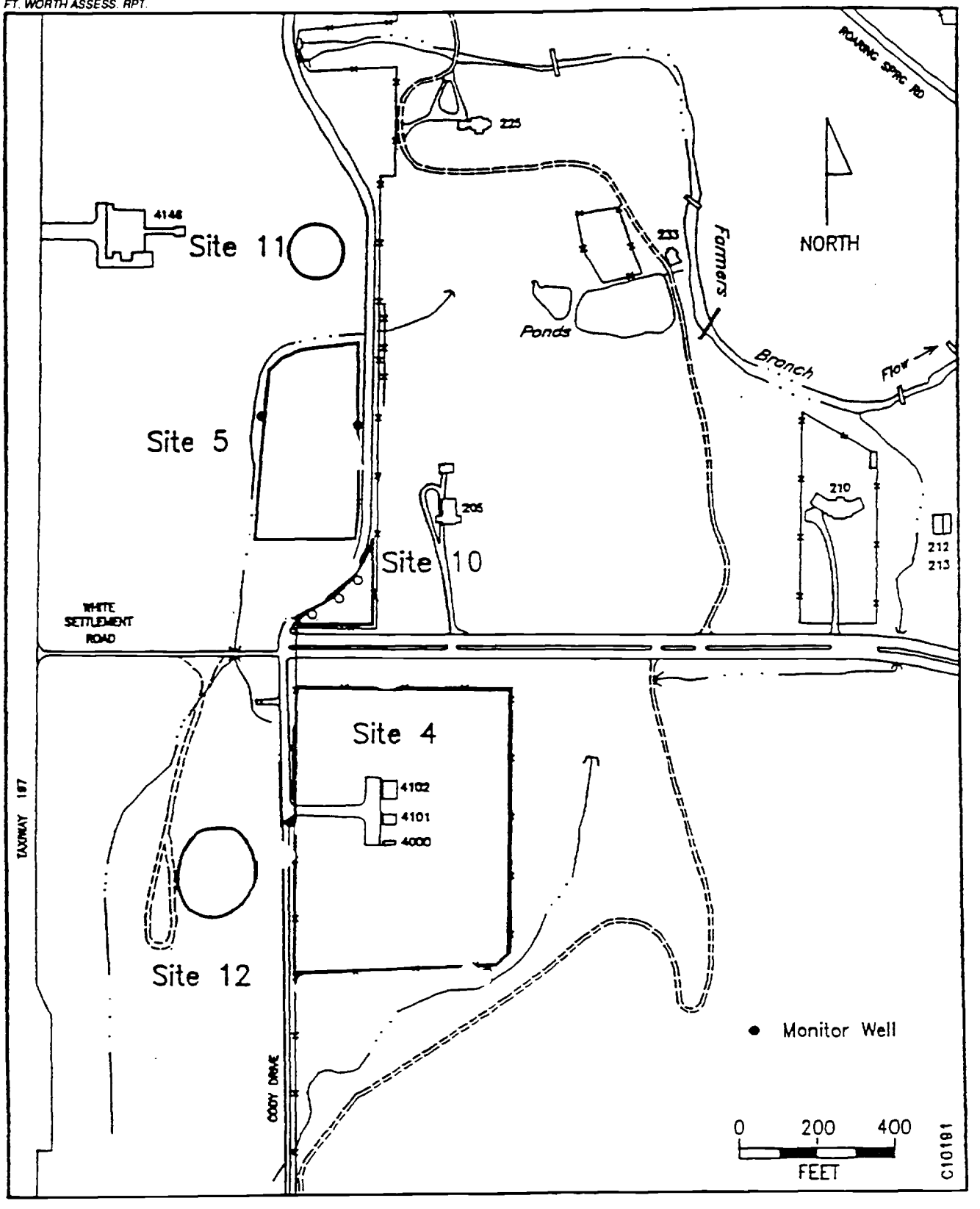


Figure 3.2-12
SITE MAP--SITE #11 (FDTA 1)

SOURCE: RADIAN, 1989; ESE.

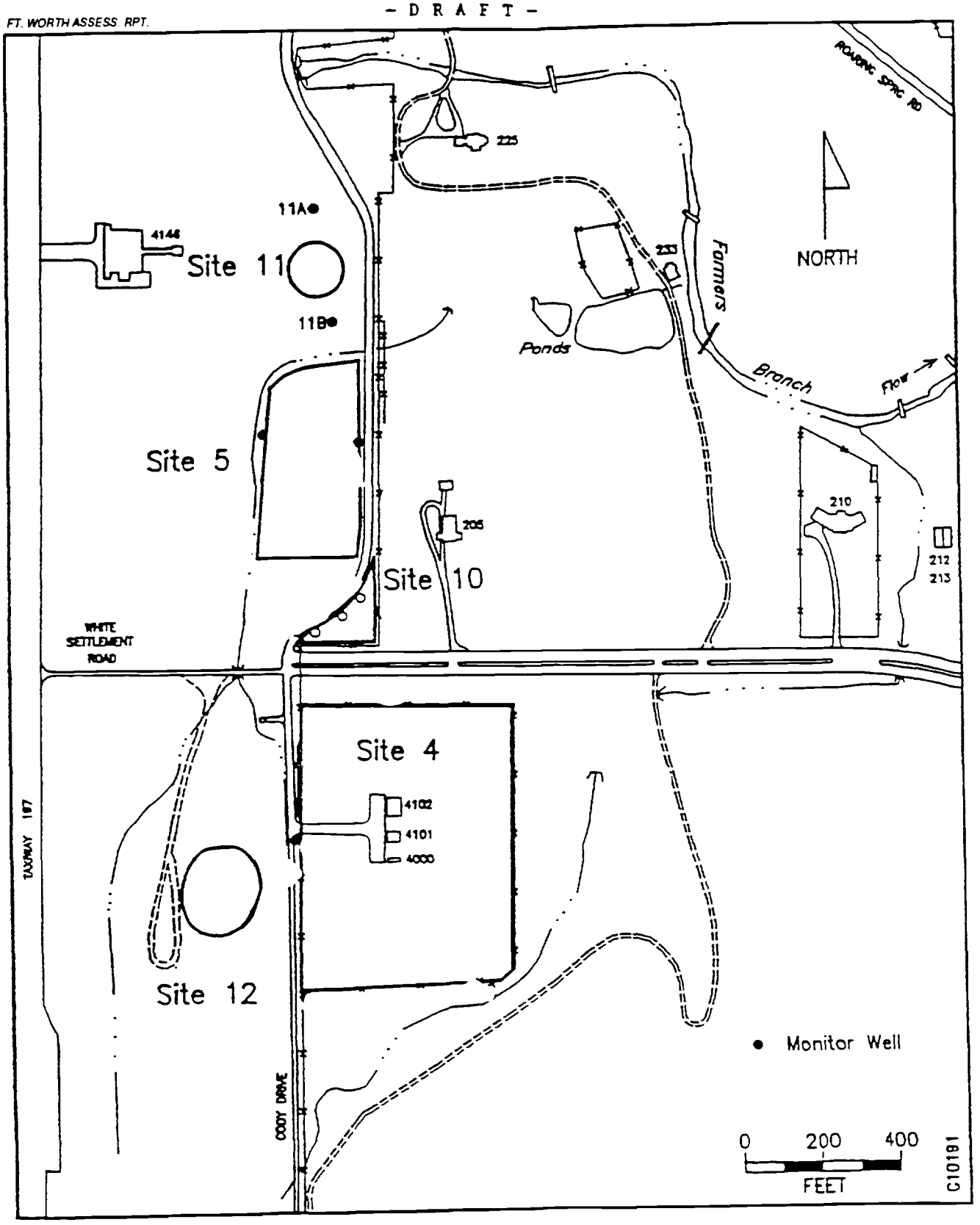


Figure 3.2-13
SAMPLING LOCATIONS--FDTA 1

SOURCE: RADIAN, 1989; ESE.

Two reports are considered to contain pertinent information regarding the investigations at Site 11. The reports are as follows:

1. Radian Corporation, 1986, Phase II Confirmation/ Quantification, Stage 1 Investigation (CAFB-83); and
2. Radian Corporation, 1991, RI/FS - Flightline Area (CAFB-76/74).

A summary of each of these reports is provided in Appendix B. A listing of the reports containing specific information about FDTA 1 is shown in Table 3.2-1.

3.2.7 SITE NO. 12 - FDTA 2

FDTA 2 is located between the north-south taxiway and the radar facility (Figure 3.2-14). This site has been in use since Area No. 1 was placed out of service in 1963. The fire pit is gravel lined and constructed with a low earthen berm around the perimeter. There are several underground and aboveground storage tanks at the training area used for storage of the flammable liquids used in the training exercises.

The subsurface investigation at Site 12 occurred during three separate studies. Five monitor wells and six borings were installed during these investigations at those locations shown in Figure 3.2-15. The monitor wells (12A, 12B, 12C, 12D and 12E) were installed just outside of the fire pit whereas the soil borings (designated 12F through 12K) were installed within the pit boundary. All of the wells are completed within the Upper Zone. Soil and groundwater have been collected from the wells and borings were sent to a laboratory for analyses.

The investigation results show that significant levels of halogenated and aromatic organic compounds were present in the soil (up to 752 μg/G) and the groundwater (up to 362 μg/L) of the Upper Zone. The highest levels of contaminants occurred at the center of the site, where elevated levels of benzene, toluene, and ethyl benzene were detected. TCE was also detected in the groundwater downgradient (north and east) of the site. The surface water in the

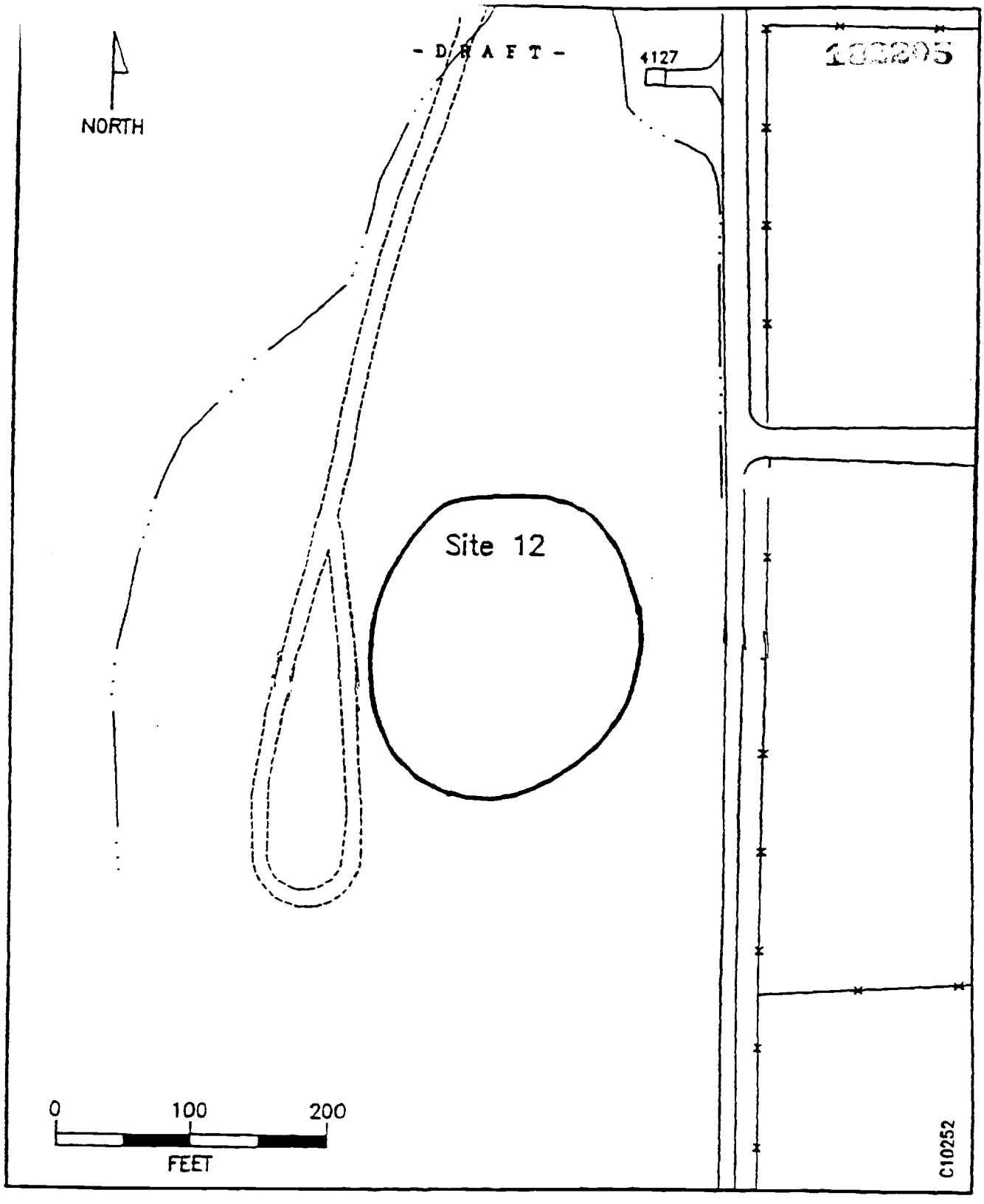


Figure 3.2-14
SITE MAP--SITE #12 (FDTA 2)

SOURCE: RADIAN, 1989; ESE.

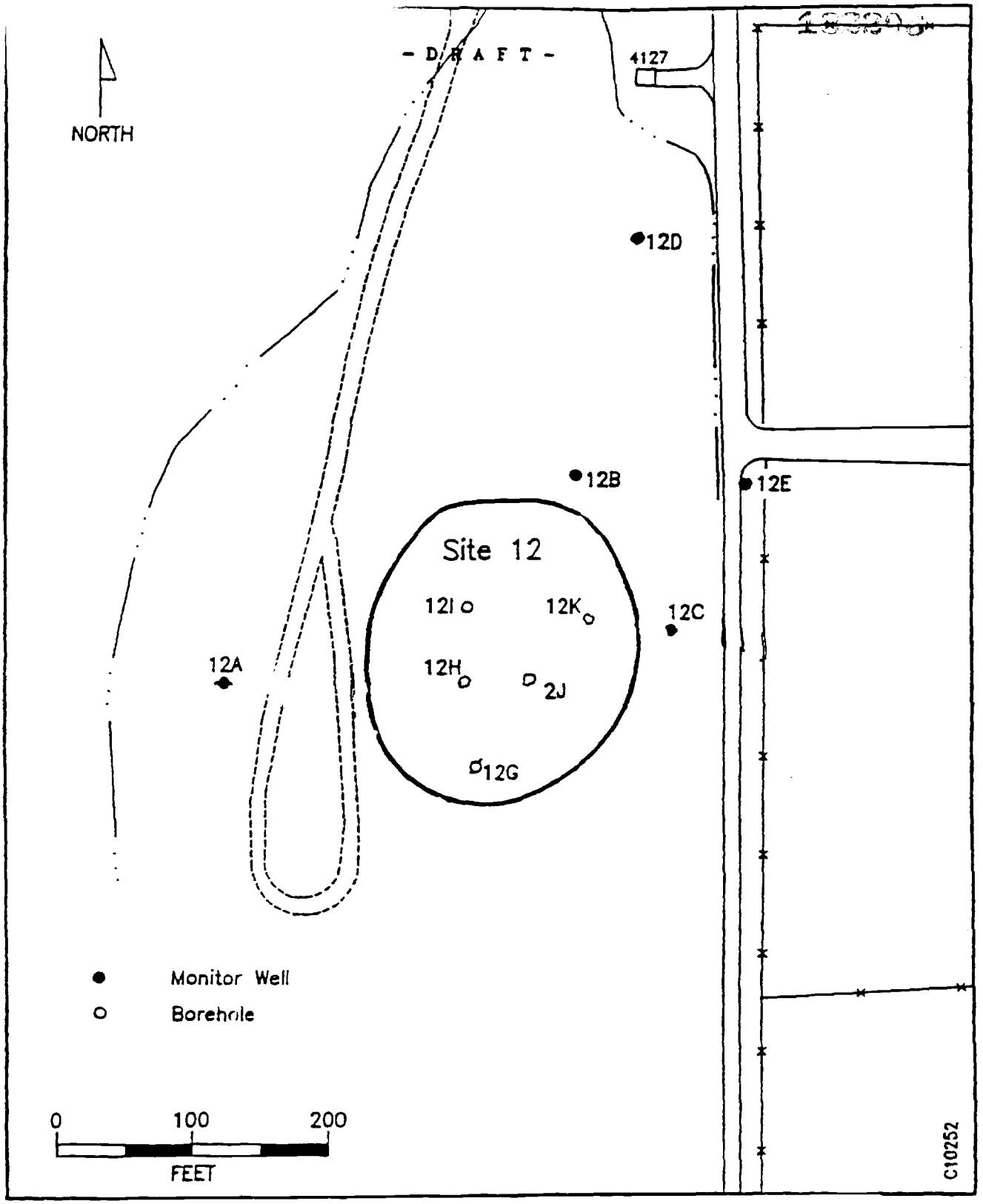


Figure 3.2-15
SAMPLING LOCATIONS--FDTA 2

SOURCE: RADIAN, 1989; ESE.

drainage ditch near the site showed elevated level of oil and grease. As part of the RI, approximately 5,700 yd^3 of contaminated soil was removed for biological treatment onsite.

Four reports are considered to contain pertinent information regarding the investigations at Site 12. The reports are as follows:

1. Radian Corporation, 1986, Phase II Confirmation/ Quantification, Stage 1 Investigation (CAFB-83);
2. Radian Corporation, 1988, Phase II Confirmation/ Quantification, Stage 2 Investigation (CAFB-1);
3. Radian Corporation, 1989, RI/FS, Stage 2 Investigation (CAFB-NA1); and
4. Radian Corporation, 1991, RI/FS - Flightline Area (CAFB-76/74).

A summary of each of these reports is provided in Appendix B. A listing of the reports containing specific information about FDTA 2 is shown in Table 3.2-1.

3.2.8 SITE NO. 13 - FLIGHTLINE DRAINAGE DITCH

The Flightline Drainage Ditch is located east of Haile Drive, directly east of the main aircraft washrack and Hangers 1048 and 1049 (Figure 3.2-16). The ditch receives runoff from the flightline area via a 3-ft concrete conduit located beneath Haile Drive. The ditch is unlined in the stretch extending from Haile Drive to the POL Tank Farm. At that point, the ditch is lined with concrete. The ditch drains into a storm sewer at the intersection of Knights Lake Road and the Hobby Shop Road. Before dumping into Farmers Branch, the flow is diverted into an NPDES outfall at Jennings Drive. In addition to receiving normal storm runoff, the Flightline Drainage Ditch receives discharge from the aircraft washracks and from the Fuel Systems Shop. Washrack wastes are discharged to an oil/water separator adjacent to the ditch.

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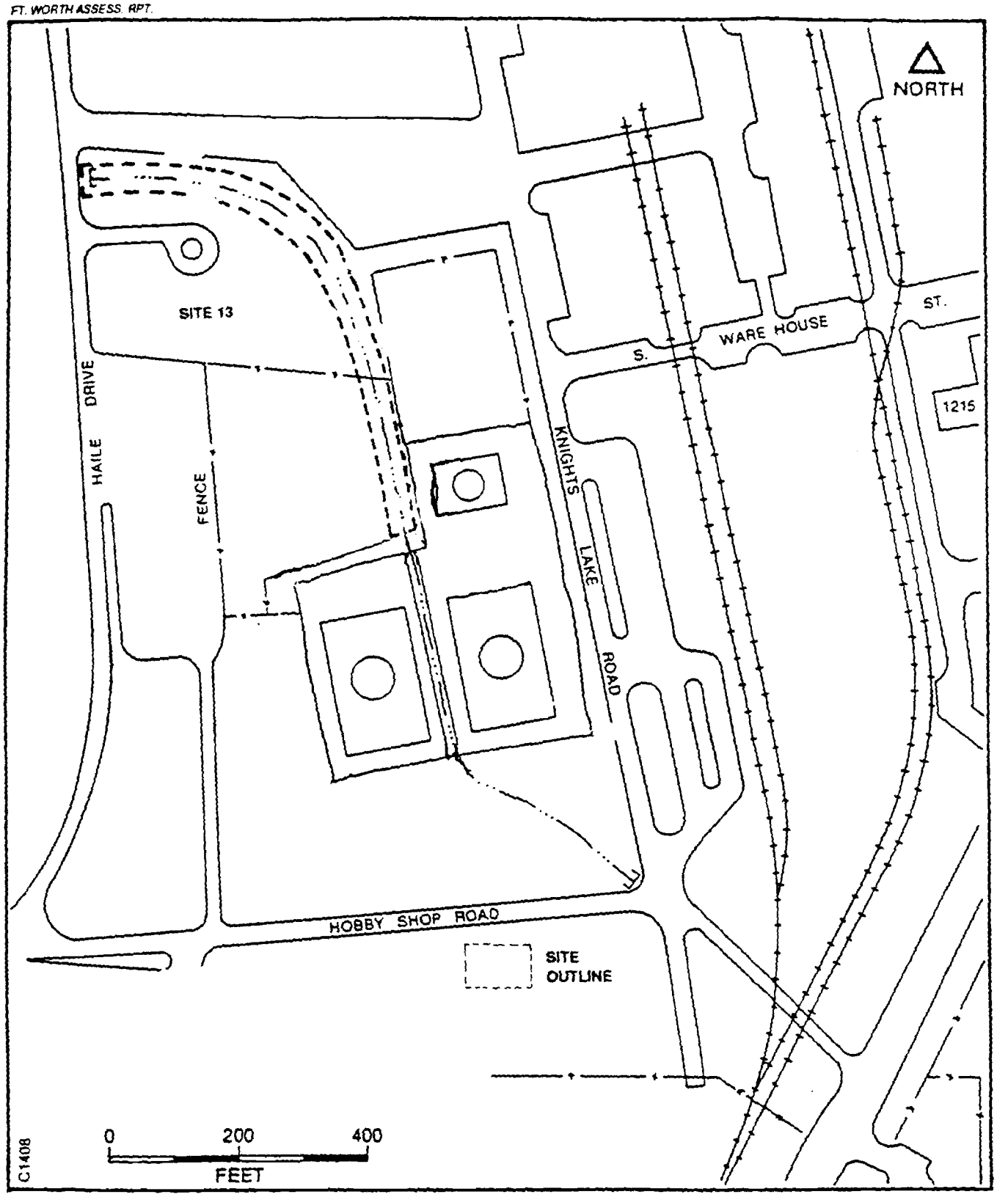

Figure 3.2-16
SITE MAP--SITE #13 (FLIGHTLINE DRAINAGE DITCH)

SOURCE: RADIAN, 1989; ESE.

The subsurface investigation at Site 13 included the installation of collection of stream sediment samples designated 13G, 13H, and 13I (Figure 3.2-17). Six soil borings (designated 13A through 13F) (Figure 3.2-17) were installed to sample the soil in and around the ditch throughout its extent from Haile Drive to the north side of the POL Tank Farm (Site #17). The sediment samples were collected for laboratory analyses.

The soil was shown to be impacted with low concentrations of jet fuel and detergents. As part of the RI, approximately 700 yd^3 of contaminated soil were excavated.

Two reports are considered to contain pertinent information regarding the investigations at Site 13. These reports are as follows:

1. Radian Corporation, 1986, Phase II Confirmation/Quantification, Stage 1 Investigation (CAFB-83); and
2. Radian Corporation, 1991, RI/FS - East Area (CAFB-101/75).

A summary of each of these reports is provided in Appendix B. A listing of the reports containing specific information about the Flightline Drainage Ditch is shown in Table 3.2-1.

3.2.9 SITE NO. 15 ENTOMOLOGY DRY WELL

Site 15 is located immediately west of the old entomology shed (Building 1338), in the current location of the Civil Engineering Compound (Figure 3.2-18). A dry well on the site was used for disposal of insecticide rinsate between 1965 and 1981. The site is currently vacant, Building 1338 has been demolished, and the site has been regraded. Building 1338 was used for the storage and mixing of insecticides, and for the storing and cleaning of spray equipment.

The subsurface investigation at Site 15 was performed during three separate investigations and included the installation of seven boreholes (15D through

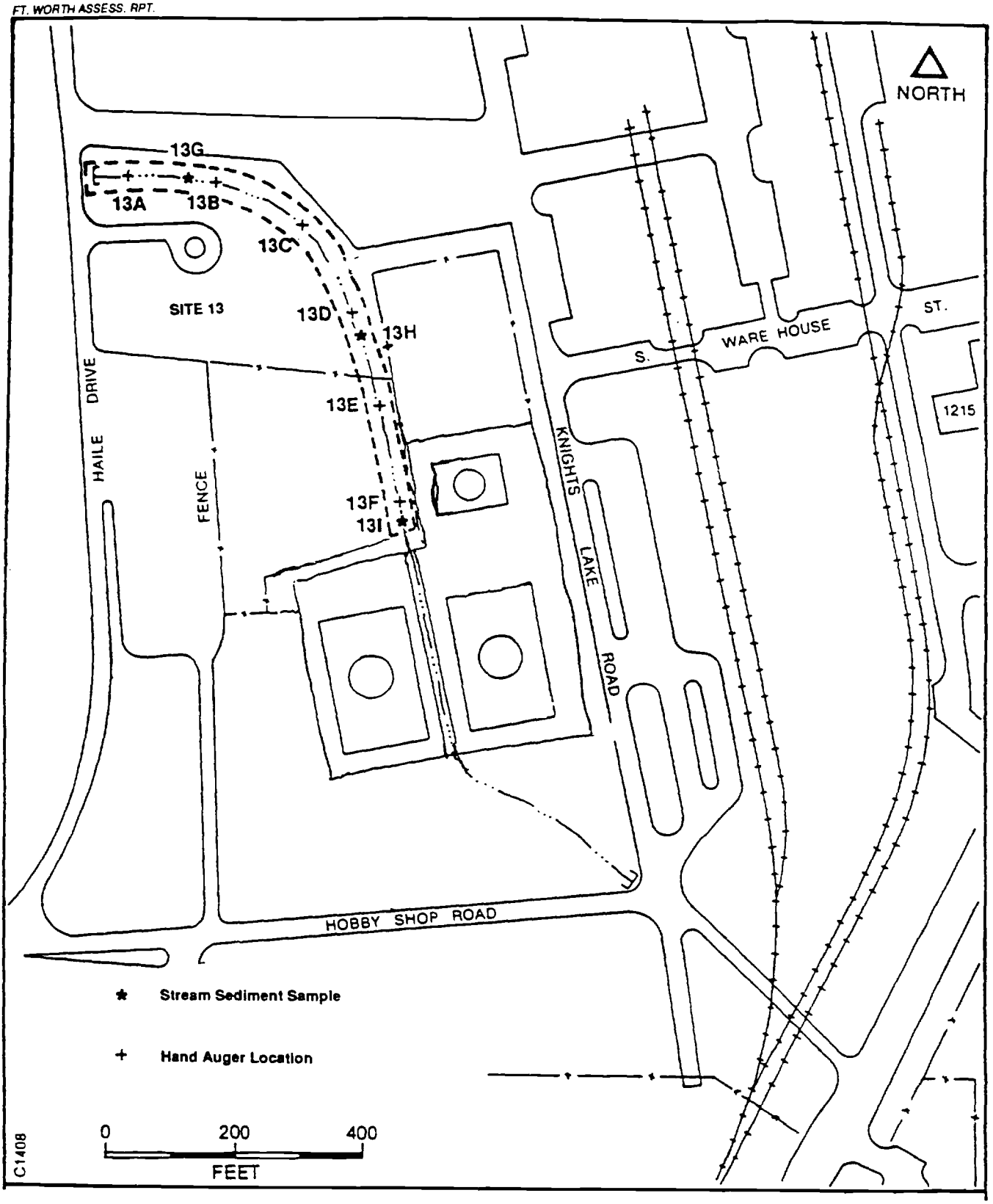

Figure 3.2-17
SAMPLING LOCATIONS, FLIGHTLINE DRAINAGE DITCH

SOURCE: RADIAN, 1989; ESE.

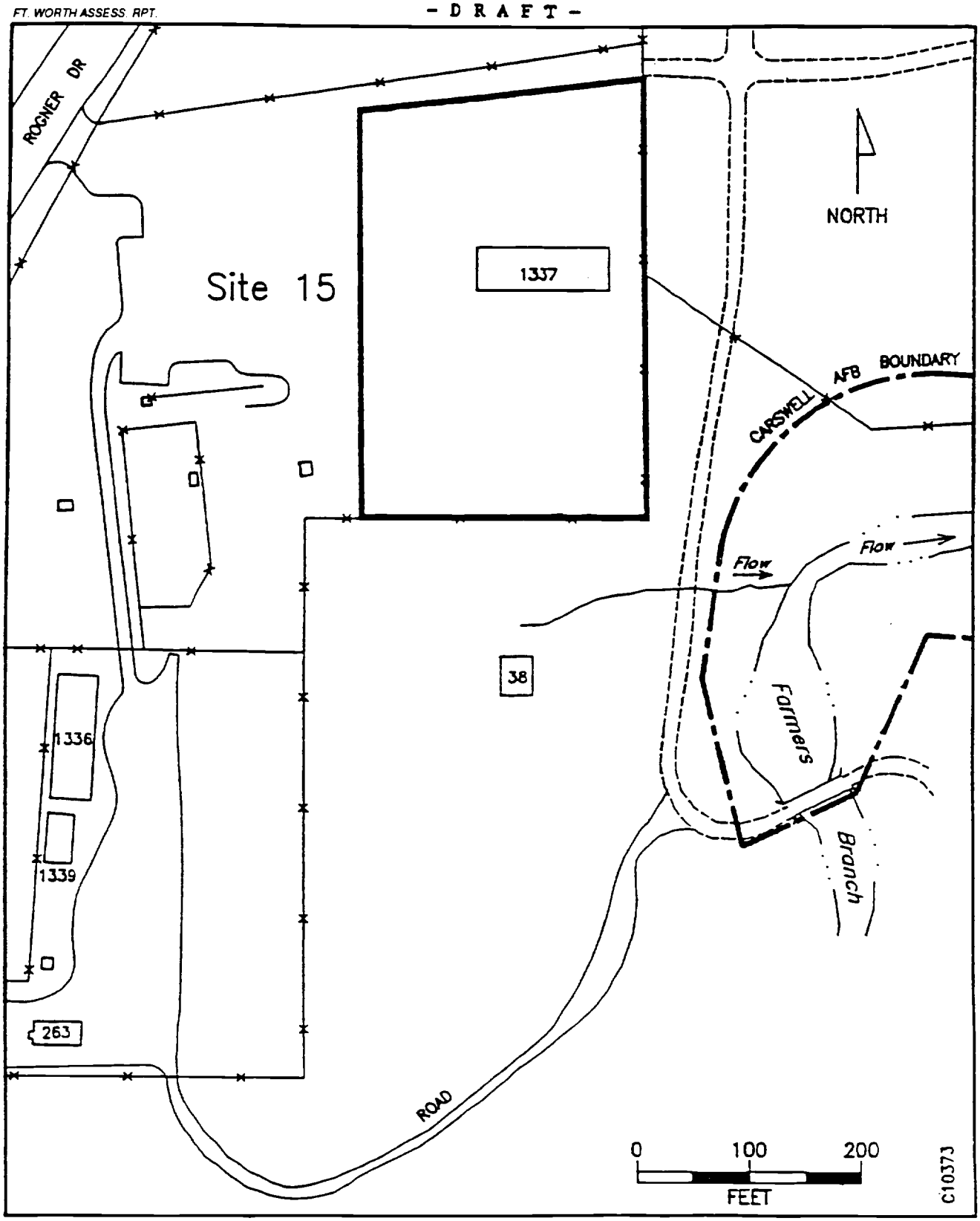

Figure 3.2-18
SITE MAP--SITE #15 (ENTOMOLOGY DRY WELL)

SOURCE: RADIAN, 1989; ESE.

15J) and three monitor wells (15A through 15C). The location of the borings and wells are presented in Figure 3.2-19. The seven borings were progressed 5 ft-bls using hand augers. These borings were placed on the southeast corner of the site. Soil samples were collected from these borings for laboratory analyses. The monitor wells were completed within the surficial deposits to test the quality of the Upper Zone at the site.

The results of the investigations showed that pesticides were present within the soil near the surface, but were not present within the groundwater of the Upper Zone.

Four reports are considered to contain pertinent information regarding the investigations at Site 15. These reports are as follows:

1. Radian Corporation, 1986, Phase II Confirmation/Quantification, Stage 1 Investigation (CAFB-83);
2. Radian Corporation, 1988, Phase II Confirmation/Quantification, Stage 2 Investigation (CAFB-1);
3. Radian Corporation, 1989, RI/FS, Stage 2 Investigation (CAFB-NA1); and
4. Radian Corporation, 1991, RI/FS - East Area (CAFB-101/75).

A summary of each of these reports is provided in Appendix B. A listing of the reports containing specific information about the Entomology Dry Well is shown in Table 3.2-1.

3.2.10 SITE NO. 16 UNNAMED STREAM

Site 16 is a small tributary of Farmers Branch that emerges from an underground oil/water separator south of the new communications building (Building 1337), near the confluence of Farmers Branch and the Trinity River (Figure 3.2-20). This small stream carries the discharge from an oil/water separator located immediately south of the fenced civil engineering yard, and receives its perennial

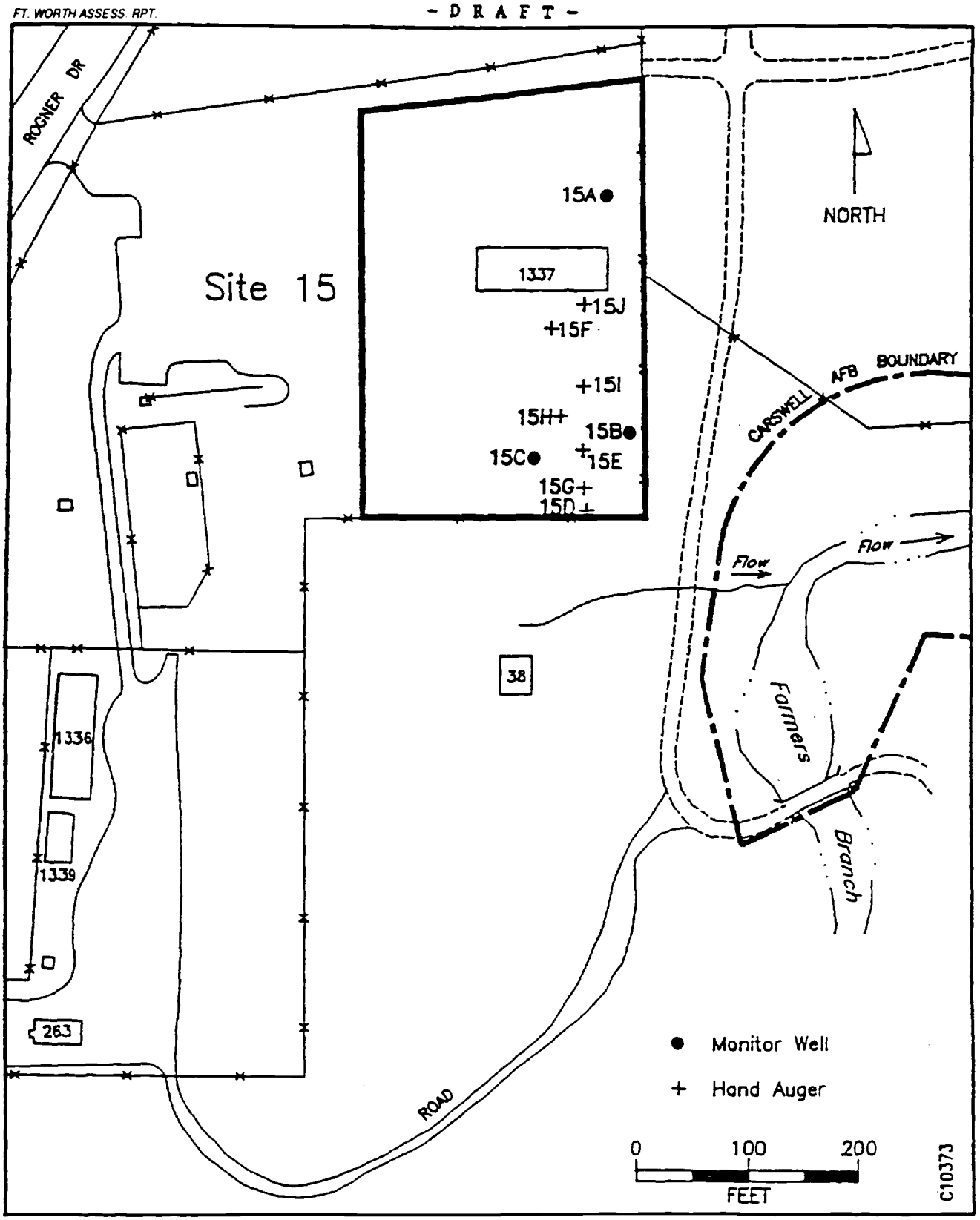

Figure 3.2-19
SAMPLING LOCATIONS--ENTOMOLOGY DRY WELL SITE

SOURCE: RADIAN, 1989; ESE.

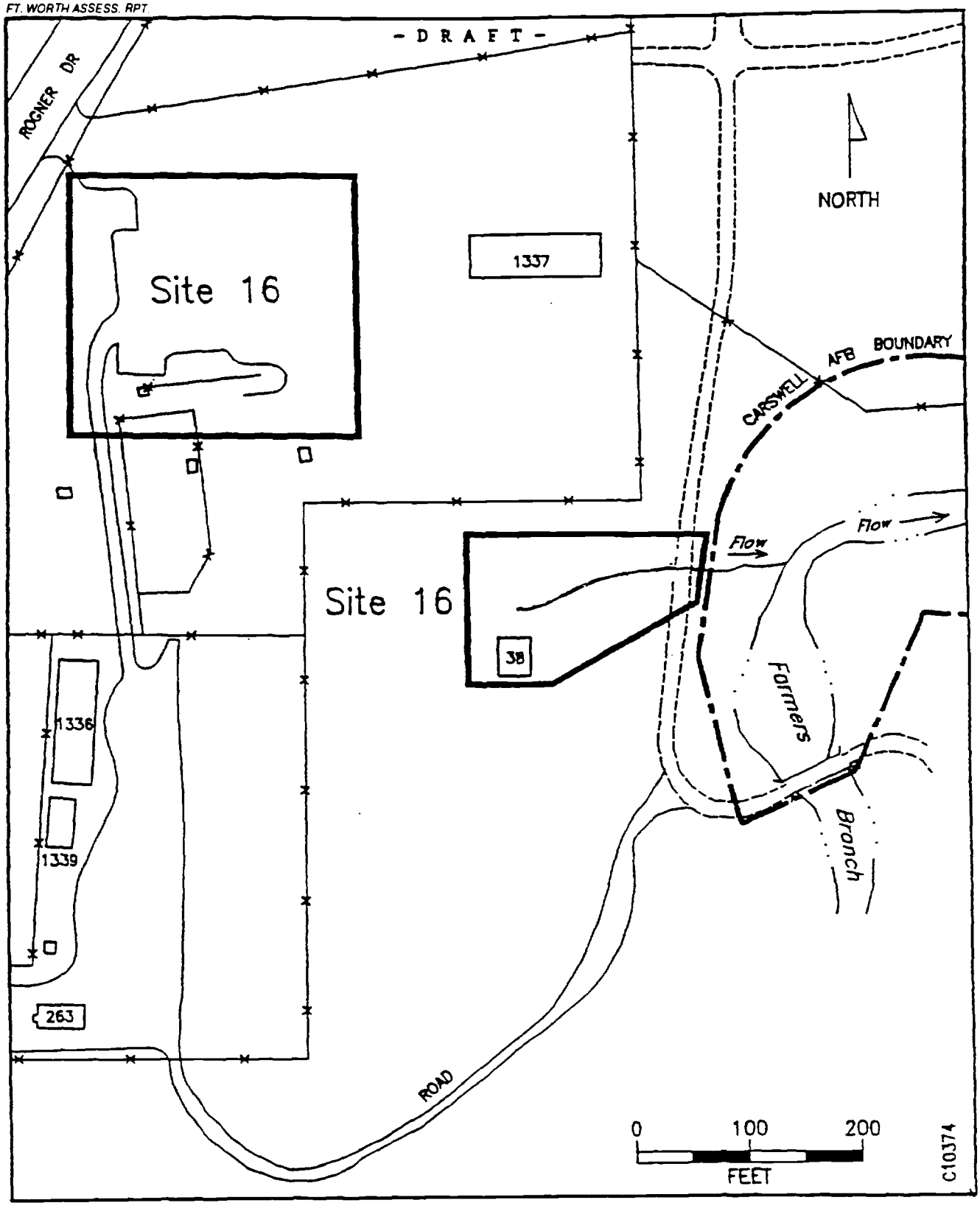

Figure 3.2-20
SITE MAP--SITE #16 (UNNAMED STREAM)

SOURCE: RADIAN, 1989; ESE.

flow from groundwater entering the separator. The separator is connected to a trench underdrain system which was installed in 1965 due to a fuel leak at the former CAFB service station. This separator has not been cleaned regularly and reportedly contained hydrocarbon constituents.

The investigation at Site 16 was performed during Stage 1 of the Phase II investigation. The investigation consisted of the collection of four surface water samples for laboratory analyses at those locations shown in (Figure 3.2-21).

Elevated concentrations of refined hydrocarbon products were detected in the surface water samples. The source of the contamination is either the former service station, which was located nearby, or the POL Tank Farm (Site 17).

Two reports are considered to contain pertinent information regarding the investigations at Site 16. These reports are as follows:

1. Radian Corporation, 1986, Phase II Confirmation/Quantification, Stage 1 Investigation (CAFB-83); and
2. Radian Corporation, 1991, RI/FS - East Area (CAFB-101/75).

A summary of each of these reports is provided in Appendix B. A listing of the reports containing specific information about Unnamed Stream is shown in Table 3.2-1.

3.2.11 SITE NO. 17 POL TANK FARM

Site 17 is located on Knights Lake Road, north of the Hobby Shop (Figure 3.2-22). The site originally contained seven aboveground storage tanks, but currently only three are in operation. During the 1960s, free product (fuel) was discovered below the ground surface in the vicinity of the tank farm. A french drain system was installed downgradient from the discovery to collect the fuel. The french drain discharges through the oil/water separator located on the Unnamed Stream (Site 16).

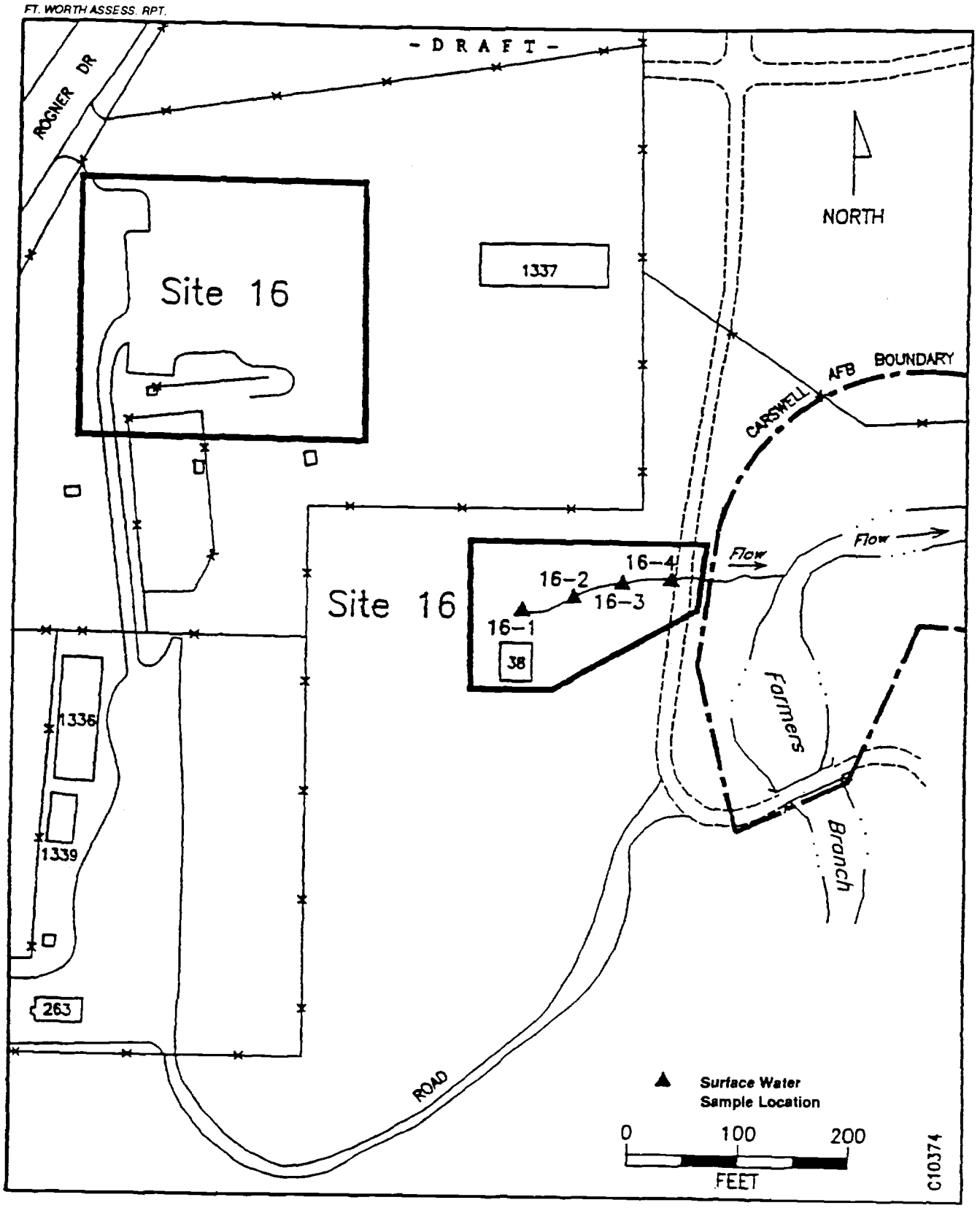

Figure 3.2-21
SAMPLING LOCATIONS--UNNAMED STREAM SITE

SOURCES: RADIAN, 1989; ESE.

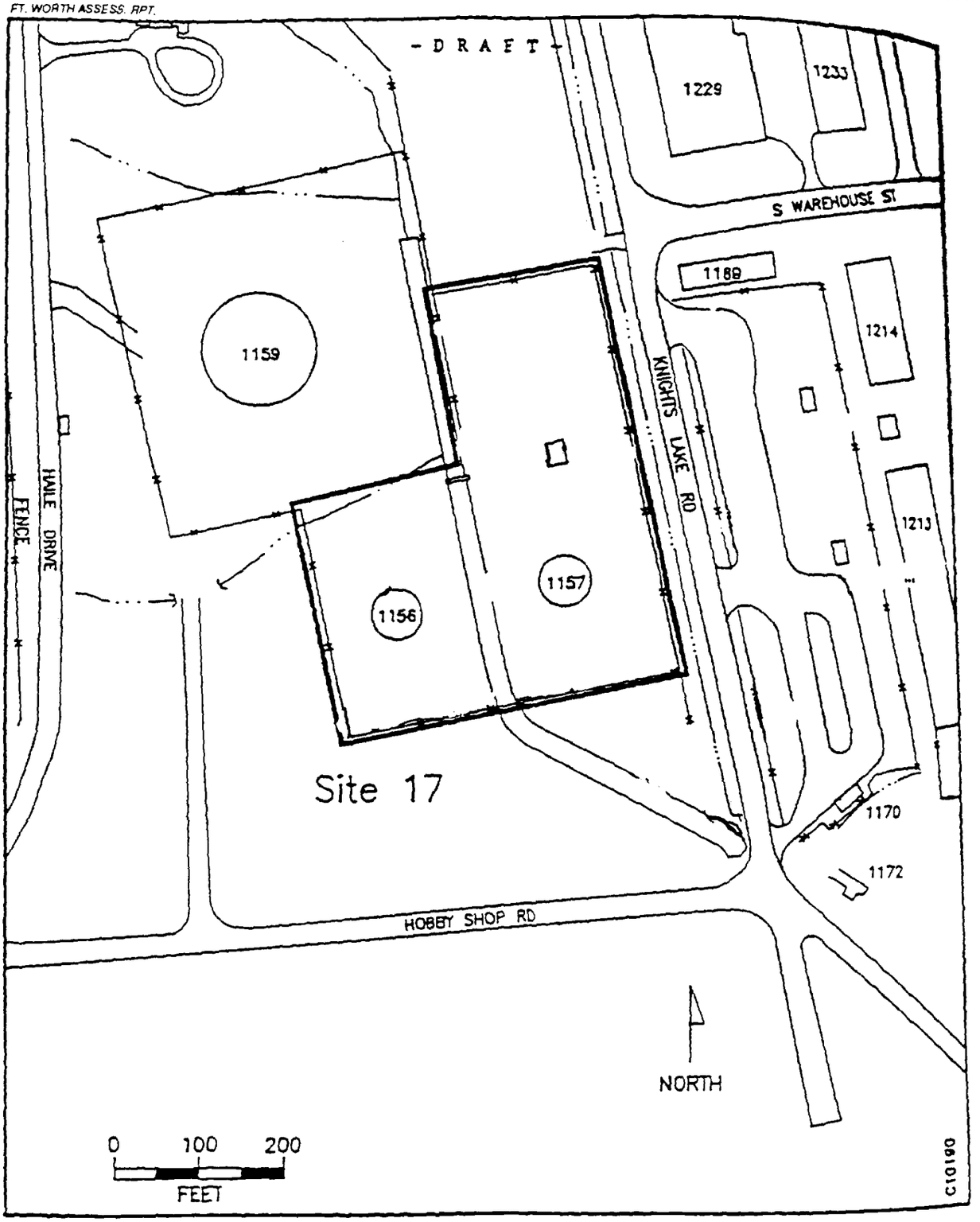

Figure 3.2-22
SITE MAP--SITE #17 (POL TANK FARM)

SOURCE: RADIAN, 1989; ESE.

The subsurface investigation at Site 17 was performed during three separate investigations and included the installation of thirteen monitor wells (Figure 3.2-23). The monitor wells were installed in the southeast corner of the tank farm and downgradient of the farm. All of the wells were completed within the surficial deposits test the quality of the Upper Zone in the area.

The results of the investigation showed that organic compounds were present in the soil and the groundwater of the Upper Zone beneath the POL Tank Farm. The source of the contaminants are thought to be fuel released from the storage tanks at the tank farm. Groundwater within the Upper Zone flows southeast beneath the site. As part of the RI, an oil skimmer was installed in 1991.

Four reports are considered to contain pertinent information regarding the investigations at Site 17. These reports are as follows:

1. Radian Corporation, 1986, Phase II Confirmation/Quantification, Stage 1 Investigation (CAFB-83);
2. Radian Corporation, 1988, Phase II Confirmation/Quantification, Stage 2 Investigation (CAFB-1);
3. Radian Corporation, 1989, RI/FS, Stage 2 Investigation (CAFB-NA1); and
4. Radian Corporation, 1991, RI/FS - East Area (CAFB-101/75).

A summary of each of these reports is provided in Appendix B. A listing of the reports containing specific information about POL Tank Farm is shown in Table 3.2-1.

3.2.12 BSS

The BSS is located on the northeast corner of the intersection of Rogner Drive and Jennings Drive (Figure 3.2-24). The station has been in service for approximately 20 years and was built to replace the abandoned service station.

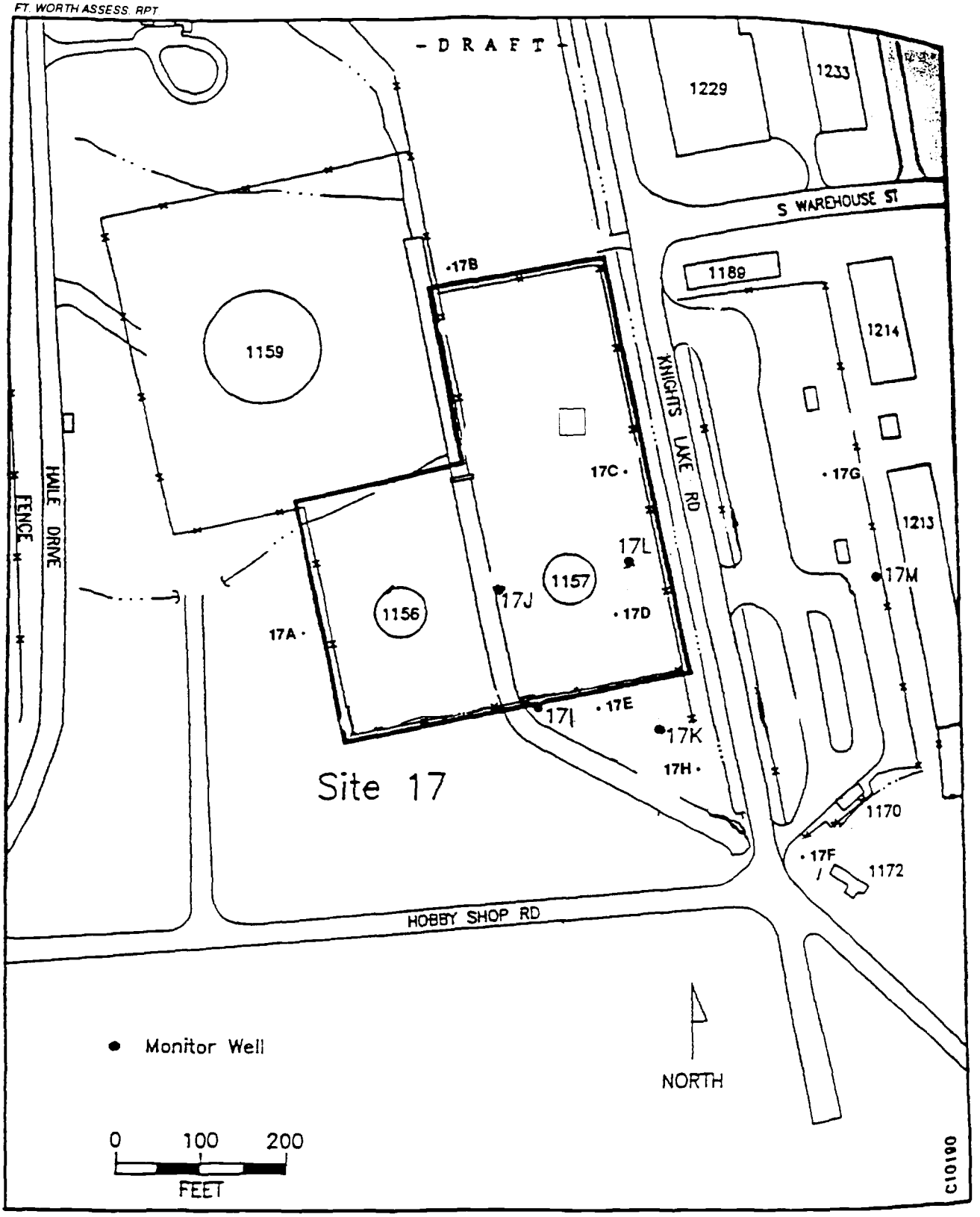

Figure 3.2-23
SAMPLING LOCATIONS--POL TANK FARM

SOURCES: RADIAN, 1989; ESE.

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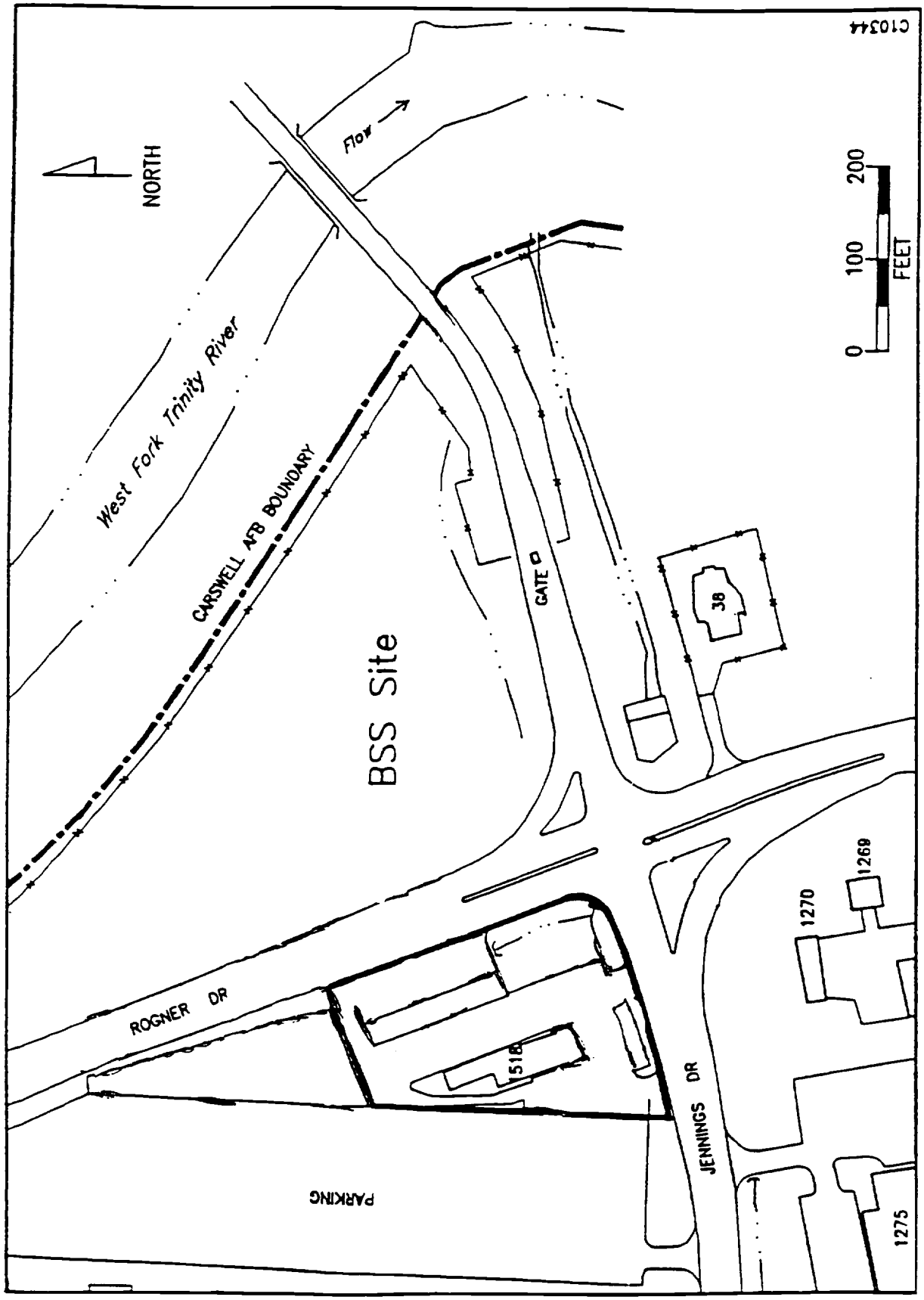

Figure 3.2-24
SITE MAP--BASE SERVICE STATION

SOURCE: RADIAN, 1999; ESE.

The subsurface investigation at the BSS was performed during several investigations which included the installation of three monitor wells (MW-A, MW-B, and MW-C) (Figure 3.2-25) and four soil borings (E through G). The investigations have also included several rounds of soil gas and surface water sampling.

The results of the investigation have shown the presence of elevated levels of BTEX, MTBE, and TRPH in the groundwater of the Upper Zone aquifer beneath the site. The groundwater within the Upper Zone in the area of the BSS flows northeast toward the Trinity River.

Five reports are considered to contain pertinent information related to the investigations at the BSS. These reports are as follows:

1. Radian Corporation, 1988, Phase II Confirmation/Quantification, Stage 2 Investigation (CAFB-1);
2. Radian Corporation, 1989, RI/FS, Stage 2 Investigation (CAFB-NA1);
3. Radian Corporation, 1991, RI/FS - East Area (CAFB-101/75);
4. U.S. Army Corps of Engineers, 1993, Sampling Results (CAFB-X2); and
5. Target Environmental Services, 1993, Soil Gas Survey (CAFB-X7).

A summary of each of these reports is provided in Appendix B. A listing of the reports containing specific information about BSS is shown in Table 3.2-1.

3.2.13 WEAPONS STORAGE AREA

The Weapons Storage Area is located about 6 miles west of CAFB, just north of White Settlement Road. The Weapons Storage Area was built in 1956. The site includes two munitions inspection shops (Building 8503), 16 ordnance storage buildings, one entry-control building, an emergency power plant (Building 8514),

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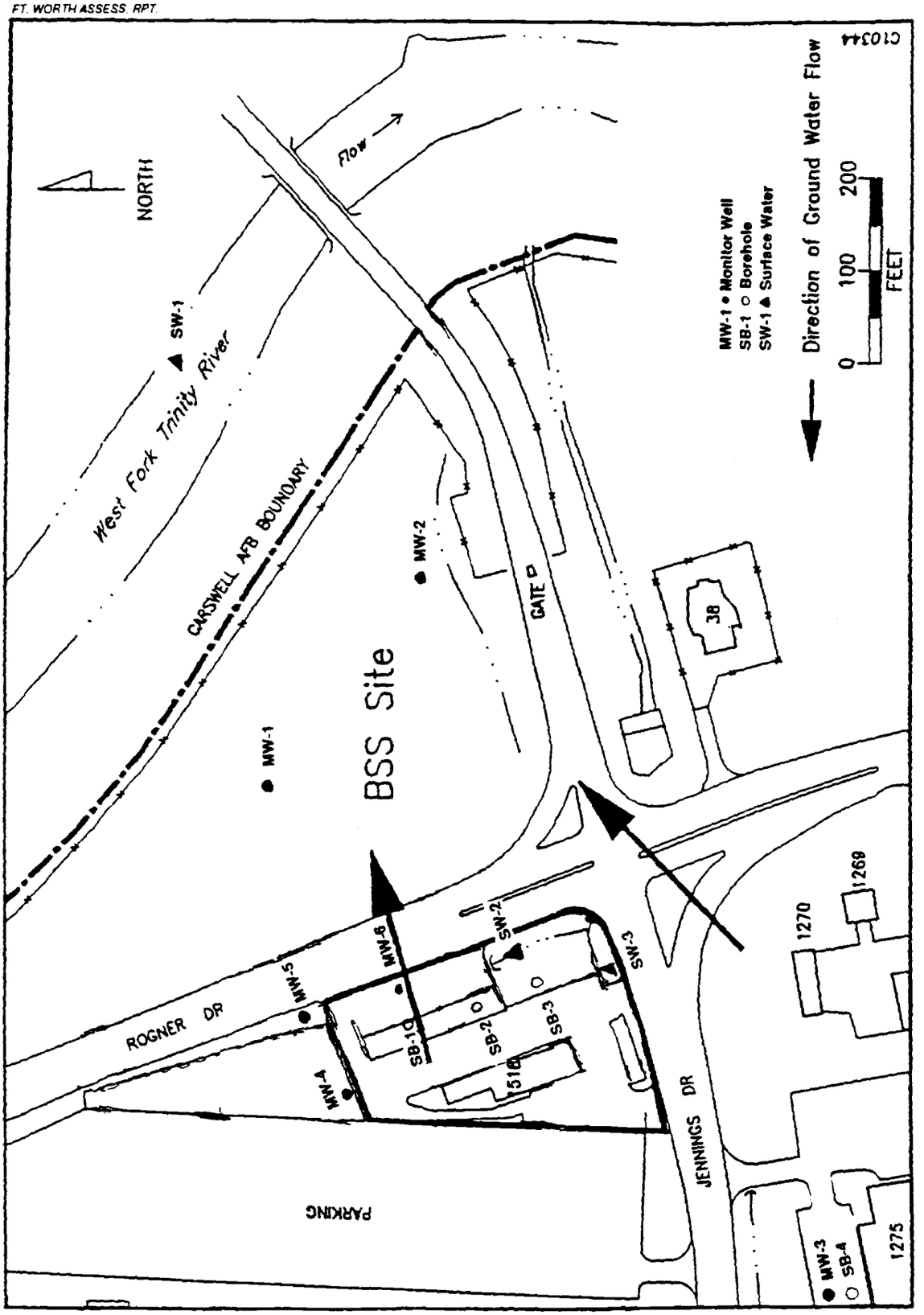

Figure 3.2-25
SAMPLING LOCATIONS, BASE SERVICE STATION

SOURCE: RADIAN, 1989; ESE.

an EOD range, a radioactive waste disposal facility, a water storage tank, and two water wells (Figure 3.2-26).

The Weapons Storage Area has been the target for the following investigations:

1. During Stage 1 of the Phase II program, an investigation was performed at the site of a recently excavated UST located near Building 8514. When active, the UST was used for waste oil storage. The investigation involved the installation of ten soil borings in the vicinity of the former UST location (Figure 3.2-27). Soil samples were collected for chemical analysis. Water samples were also collected from the two potable wells onsite. The investigation results showed that some residual hydrocarbon contamination remained in the soil. The contamination appeared to be limited to the limits of the area backfilled into the excavation. Analysis of the water sample showed radium concentration in excess of federal standards.
2. During Stage 2 of the Phase II program, eight soil borings (e through I) were installed just west of the Inspection Shop (Building 8503) due to reports that small quantities of waste cleaners and solvents have been periodically disposed of into the subsurface the vicinity of the Inspection Shop (Figure 3.2-28). The investigation results showed TCE in concentration in excess of federal standards.
3. In 1992, there was a preliminary investigation into the extent of any radium contamination in the soil and groundwater at the WSA. During the investigation, 14 shallow soil borings were installed at those locations shown in Figure 3.2-29. Soil samples were collected from the borings for laboratory analysis. Water samples were also collected from the two potable wells onsite for laboratory analysis. Radium was discovered at concentrations in excess of federal standards in both water wells and in the soil collected from borings placed near the radioactive disposal area.

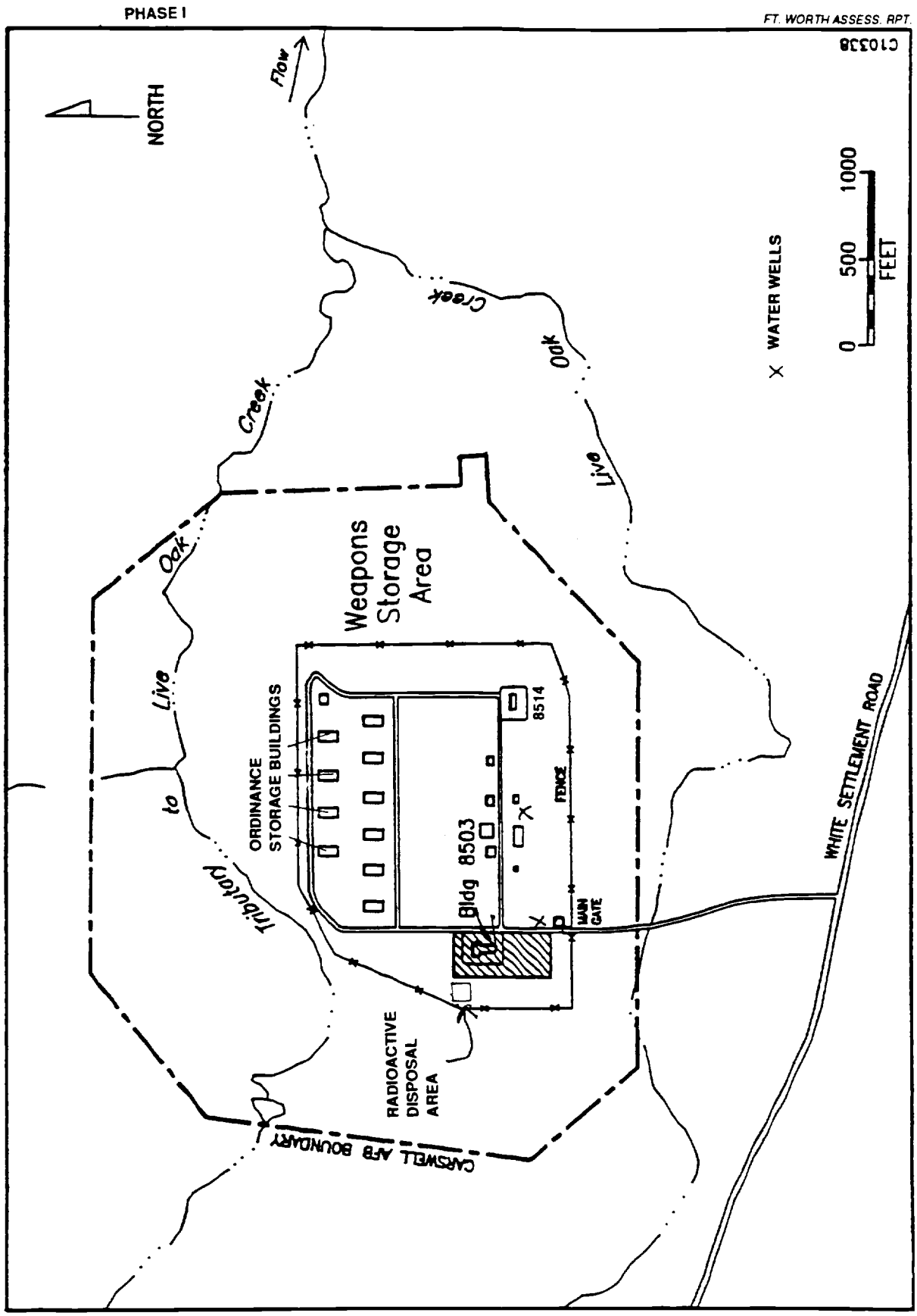

Figure 3.2-26
SITE MAP--WEAPONS STORAGE AREA

SOURCE: RADIAN, 1988; ESE.

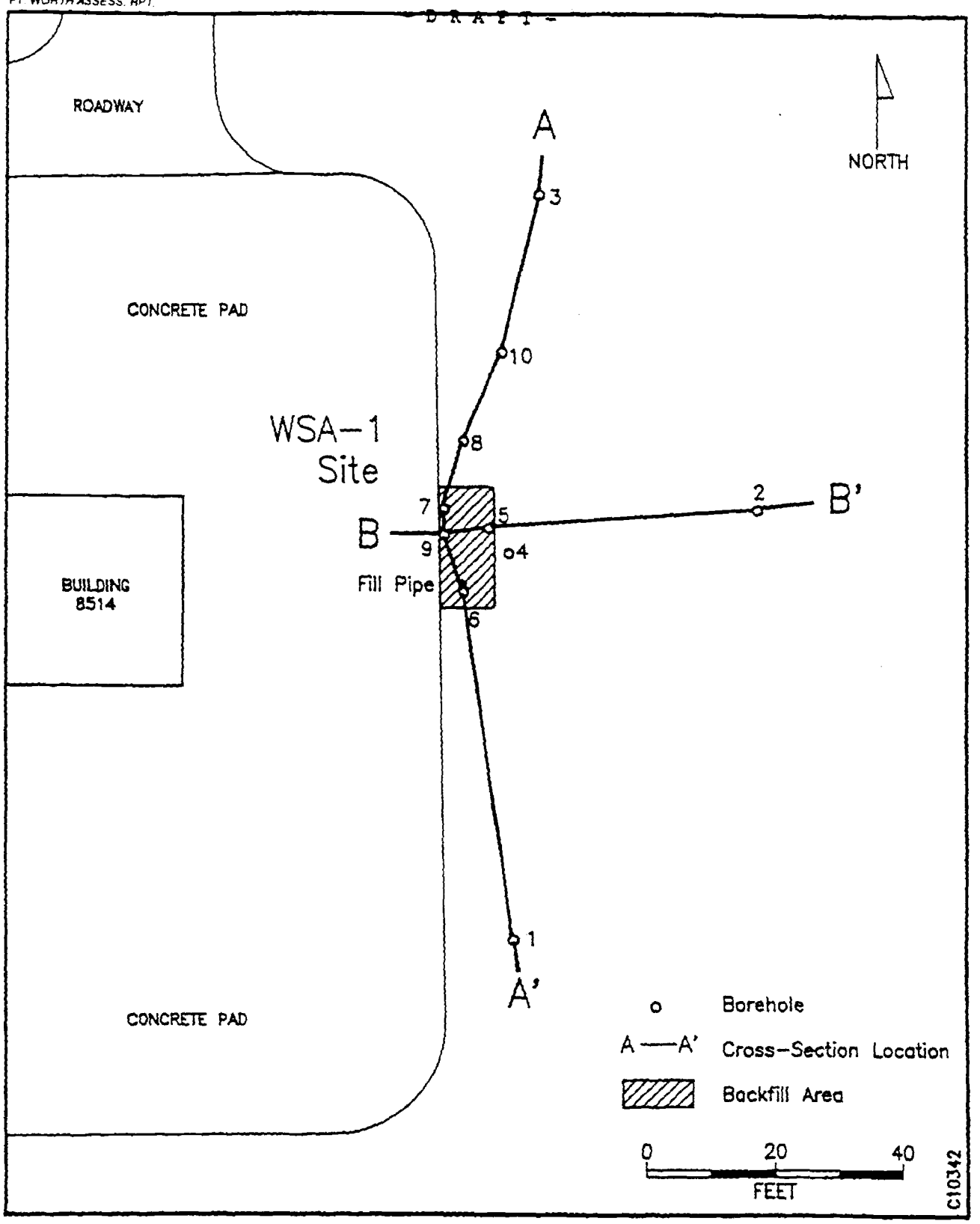

Figure 3.2-27
SAMPLING LOCATIONS, WEAPONS STORAGE AREA, STAGE 1 INVESTIGATION

SOURCE: RADIAN, 1988; ESE.

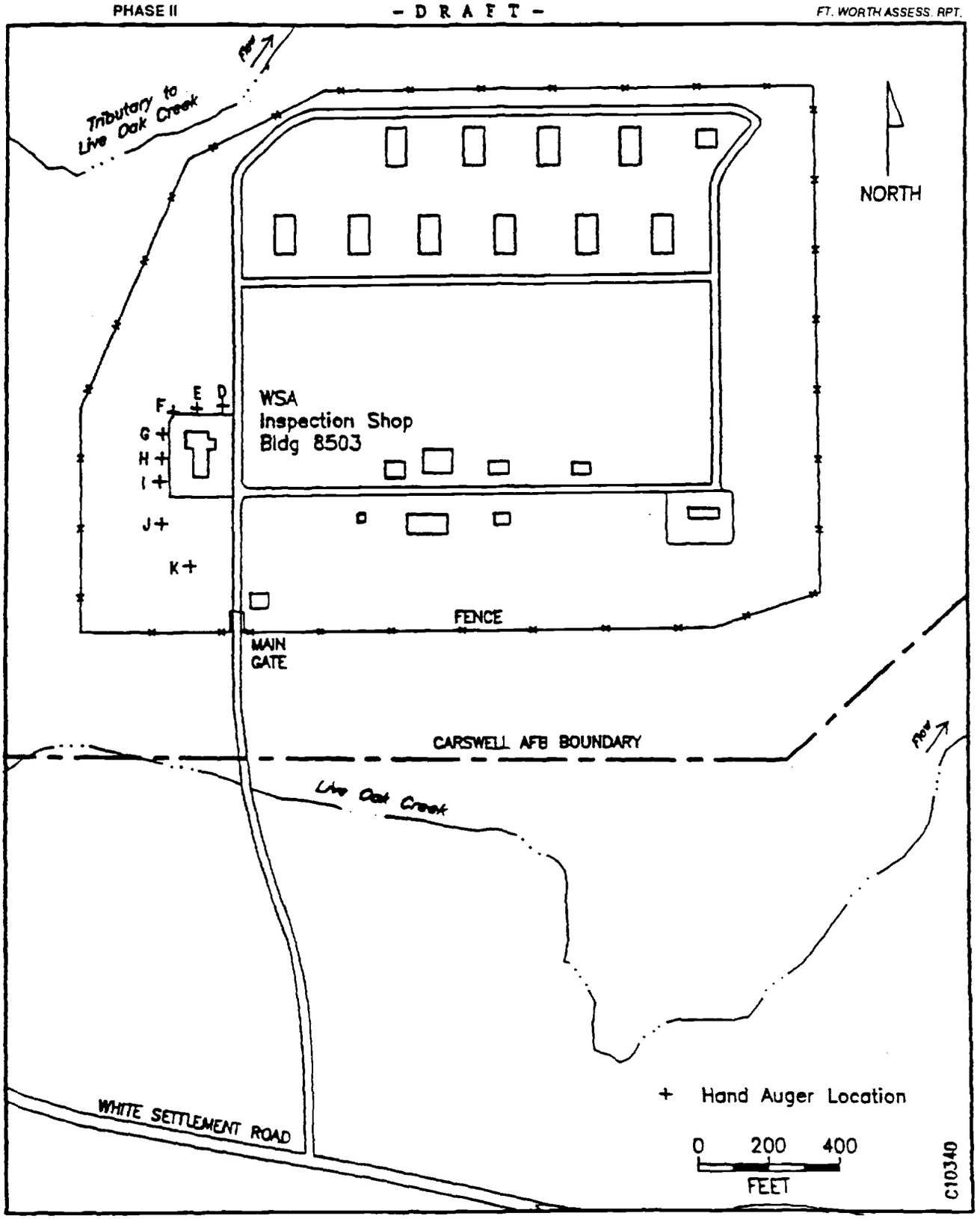

Figure 3.2-28
SAMPLING LOCATIONS, WEAPONS STORAGE AREA, STAGE 2 INVESTIGATION

SOURCE: RADIAN, 1989; ESE.

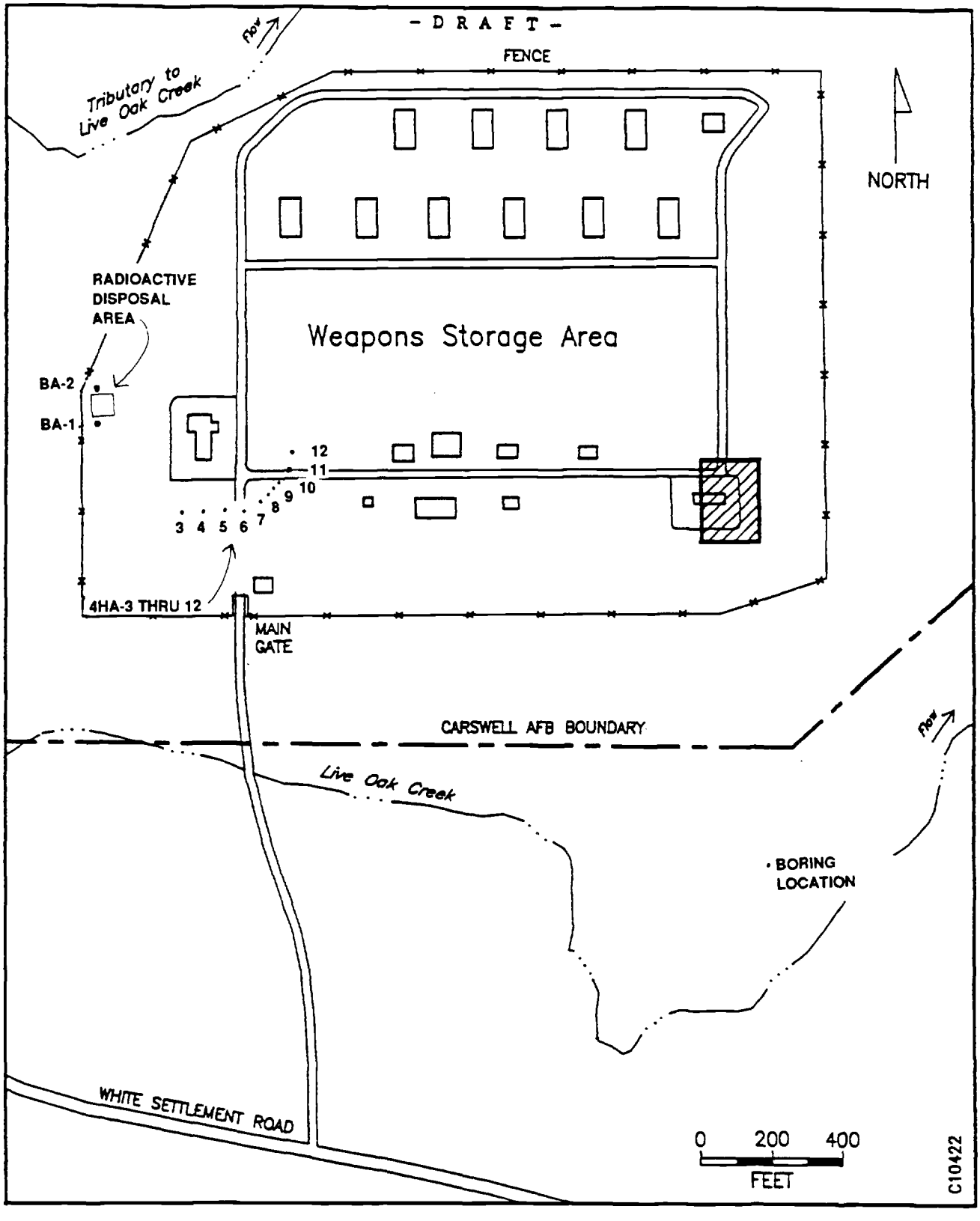

Figure 3.2-29
SAMPLING LOCATIONS, WEAPONS STORAGE AREA, RADIUM INVESTIGATION

SOURCE: RADIAN, 1989; ESE.

Four reports are considered to contain pertinent information regarding the investigations at the WSA. These reports are as follows:

1. Radian Corporation, 1988, Phase II Confirmation/Quantification, Stage 1 Investigation (CAFB-66);
2. Radian Corporation, 1988, Phase II Confirmation/Quantification, Stage 2 Investigation (CAFB-1);
3. Radian Corporation, 1989, RI/FS, Stage 2 Investigation (CAFB-NA1); and
4. U.S. Army Corps of Engineers, 1992, Preliminary Assessment of Radium Contamination - Weapons Storage Area (CAFB-X4).

A listing of the reports containing specific information about the Weapons Storage Area is shown in Table 3.2-1.

4.0 SUMMARY

Table 4.0-1 summarizes assessment activities at the 38 study sites located at AFP4 and CAFB.

Table 4.0-1. Summary of Remediation Projects at AFP4 and CAFB

Site Identification	Assessment Activities	Groundwater Results	Soil Results	Project Status
AFP4				
LF01	Monitor wells: HM-6, HM-7, HM-10, HM-18, HM-19, HM-49, HM-50, HM-62, F-216, and F-217; Paluxy wells P-4, P-7u, P-7m, P-25u, and P-25m.	Upper Zone flow system: contaminated with heavy metals, SVOCs, and VOCs (primarily solvents).	Soil is contaminated with heavy metals, SVOCs, and VOCs (primarily solvents).	Remediation phase.
LF02	Monitor wells: HM-2, HM-22, HM-40, HM-42, HM-43, and HM-46; Paluxy well: P-21u. Terrain conductivity survey.	Upper zone flow system: no contamination detected. Paluxy Formation aquifer: Negligible contamination detected.	No contamination detected.	No further action.
LF03	Monitor wells: HM-21, HM-26, HM-27, HM-34 through HM-39, F-214, W-129, W-130, and W-132 (temporary); Paluxy wells: P-10u, P-10m, P-22u, P-22m, P-24u, P-24m, and P-29m.	Upper Zone flow system: contaminated with VOCs (primarily TCE and degradation products), SVOCs, and chromium. Paluxy Formation aquifer: TCE detected in P-22u and P-22m.	15,900 yd^3 of soil contaminated with organic compounds. 3,800 yd^3 of soil contaminated with organics.	Remediation phase.
LF04	Monitor wells: HM-5, HM-9, and HM-101; Paluxy well: P-20m.	Upper Zone flow system: no contaminants detected. Paluxy Formation aquifer: no contaminants detected.	32,000 yd^3 of soil contaminated with VOCs and SVOCs; 5,300 yd^3 of this volume contaminated with metals.	Remediation phase.

Table 4.0-1. Summary of Remediation Projects at AFP4 and CAFB (Continued, Page 2 of 8)

Site Identification	Assessment Activities	Groundwater Results	Soil Results	Project Status
AFP4				
DP12	Monitor wells: HM-1, HM-15, HM-16, HM-17, HM-30, HM-32, HM-41, HM-45, F-222, W-150u, W-150l, and W-154; Paluxy well: P-2.	Upper Zone flow system: VOCs (primarily TCE) were detected; Paluxy Formation aquifer: no contamination detected.	VOCs (primarily TCE) were detected in the soils.	Remediation phase.
DP13	Monitor wells: HM-3a, HM-3b, HM-4a, HM-4b, HM-12, HM-24, HM-25, HM-28, F-221, W-128u, and W-128l.	Upper Zone flow system: VOCs, SVOCs, metals, and oil/grease.		Remediation phase.
FSA-1	Monitor wells: HM-53, HM-54, F-203 through F-207, F-211, W-136, W-139l;, W-140l, W-141l, and W-147; Paluxy wells: P-6u and P-6m. Soil gas survey.	Upper Zone flow system: VOCs, SVOCs, and fuel-related hydrocarbon; Paluxy Formation aquifer: VOCs (TCE and degradation products) and metals.		Remediation phase.
FSA-2	Monitor wells: HM-80, F-212, and W-135.	Upper Zone flow system: no contaminants detected.	Negligible amounts of TPH were detected.	
FSA-3	Monitor wells: HM-78, HM-80, F-200, F-201, F-202, F-208, F-210, F-222, F-223, and W-143; temporary wells: FSA 3-1, 3-2, 3-3, 3-4, 3-6, 3-7, 3-8, 3-10, 3-11, and 3-12. Geophysical survey. Soil gas survey.	Upper Zone flow system: JP-4 product in 7 wells, VOCs (TCE), and fuel-related hydrocarbons were detected.	46,000 yd^3 of soil contaminated with TPH.	Remediation phase.

Table 4.0-1. Summary of Remediation Projects at AFP4 and CAFB (Continued, Page 3 of 8)

Site Identification	Assessment Activities	Groundwater Results	Soil Results	Project Status
AFP4				
FDTA 2	Monitor wells: HM-49, HM-51, HM-65, HM-66, and F-213. Terrain conductivity study.	Upper Zone flow system: contaminated with fuel-related hydrocarbons, VOCs, SVOCs, and metals.	1,350 yd^3 of soil is contaminated with fuel-related hydrocarbons, VOCs, SVOCs, and metals.	Remediation phase.
FDTA 3	Monitor wells: HM-33 and HM-102.	Upper Zone flow system: negligible amounts of VOC (less than MCL).	Negligible amounts of VOCs (less than MCLs).	No further action.
FDTA 4	Soil gas survey.	Not applicable.	No soil contamination was detected.	No further action.
FDTA 5	Monitor wells: HM-25, F-221, W-131u, W-133u, and W-133l.	Upper Zone flow system: contaminated with VOCs, SVOCs, arsenic, and fuel hydrocarbons; free product was detected.	900 yd^3 of soils contaminated with VOCs, SVOCs, and fuel hydrocarbons.	Remediation phase.
FDTA 6	Paluxy well: P-3.	No groundwater contamination detected.	170 yd^3 of soil contaminated with oil/grease and toluene.	Remediation phase.
Chrome Pit No. 1	Monitor wells: HM-48 and HM-103.	Upper Zone flow system: TCE was detected.	TCE was detected at negligible levels.	No further action.
Chrome Pit No. 2	Monitor well: HM-77.	Upper Zone flow system: negligible amounts of VOCs and metals detected.	Not applicable.	No further action.
FFSA	Monitor well: HM-8.	Upper Zone flow system: no contaminants detected.	Negligible concentrations of TPH and fuel-related hydrocarbons detected.	
Solvent Lines	Monitor wells: HM-72, HM-73, HM-74, HM-75, and HM-106.	Upper Zone flow system: no contaminants detected.	No contamination detected.	No further action.

Table 4.0-1. Summary of Remediation Projects at AFP4 and CAFB (Continued, Page 4 of 8)

Site Identification	Assessment Activities	Groundwater Results	Soil Results	Project Status
AFP4				
NARF	Monitor wells: HM-83, HM-84, and HM-85.	Upper Zone flow system: no contamination detected.	No contamination detected.	No further action.
WWCB	Monitor wells: HM-47 and HM-104.	Upper Zone flow system: VOCs (TCE and degradation products), TPH, and metals.	NO contamination detected.	Remediation phase.
East Parking Lot	Monitor wells: HM--67, HM-68, HM-82, HM-86, HM-87 to HM-99, HM-110, HM-113, HM-114, HM-127, W-149, W-151, W-152, W-153, W-155, and W-156; Paluxy wells: P-8us, P-8un, P-11us, P-13us, P-15u, P-15us, P-16us, P-17us, P-18us, and P-19us. Geophysical survey.	Upper Zone flow system: VOCs (TCE and degradation products); Paluxy Formation aquifer: VOCs (TCE and degradation products).	No contamination detected.	Remediation phase. (Note: Downgradient extent of plume not determined.)
JETS	Monitor wells: HM-81, HM-105, HM-107, HM-108, and W-134.	Upper Zone flow system: TPH and SVOCs contamination.	3,000 yd^3 of soil contaminated with TPH and SVOCs.	Remediation phase.
USTs (24a and 24b)	Not applicable.	Not applicable.	Negligible amounts of TPH contamination products.	

Table 4.0-1. Summary of Remediation Projects at AFP4 and CAFB (Continued, Page 5 of 8)

Site Identification	Assessment Activities	Groundwater Results	Soil Results	Project Status
AFP4				
Assembly Building/ Parts Plant	Monitor wells: HM-31, HM-48, HM-52, HM-55, HM-56, HM-57, HM-58, HM-59, HM-64, HM-69, HM-70, F-218, F-219, HM-102, and HM-103; Paluxy wells: P-5u, P-5m, P-6u, P-6m, P-9u, P-9m, P-12u, P-12m, P-5un, P-5us, P-9un, P-9us, P-12us, and P-12un. Soil gas survey.	Upper Zone flow system: VOCs (primarily TCE and degradation product) were detected; Paluxy Formation aquifer: VOCS (primarily TCE and degradation products) detected.	Soils contaminated with VOCs (TCE) were detected east of Facilities Building and under the south end of the Assembly Building/Parts Plant which extends east until Runway 130 North.	Remediation phase.
CAFB SITES				
LF01, IRP #1	Six Upper Zone wells installed during Stages 1 and 2 of Phase II. Geophysical survey performed during Phase I.	Groundwater showed low levels of VOCs and metals.	No contamination found.	Plans have been formulated for remedial feasibility investigation (RFI), but have yet to be implemented.
LF03, IRP #3	Installation of five Upper Zone and one Paluxy Aquifer monitor wells during Stage 2 of Phase II. Geophysical survey performed during Stage 1 of Phase II.	Groundwater showed low levels of VOCs on the north side of the site and metals on the site. Contaminants limited to the Upper Zone.	No contamination found.	Plans have been formulated for RFI, but have yet to be implemented.

Table 4.0-1. Summary of Remediation Projects at AFP4 and CAFB (Continued, Page 6 of 8)

Site Identification	Assessment Activities	Groundwater Results	Soil Results	Project Status
AFP4				
LF04, IRP #4 (SWMU #24)	Installation of eight Upper Zone and one Paluxy monitor wells during Stages 1 and 2 of Phase II investigation. Geophysical survey performed during Stage 1. Surface water samples also collected during Stage 1.	Analytical results indicated that Upper Zone groundwater along east side of landfill contained elevated levels of halogenated organic compounds.	Low concentrations of organic compounds found.	Plans have been formulated for RFI, but have yet to be implemented. Interim remedial measures have begun with installation of groundwater pump and treatment system.
LF05, IRP #5 (SWMU #23)	Installation of eight Upper Zone monitor wells during Stages 1 and 2 of Phase II. Geophysical survey performed during Stage 1.	Elevated levels of organic compounds found within Upper Zone.	Significant levels of organic compounds found.	Plans have been formulated for RFI, but have yet to be implemented. Interim remedial measures have began with installation of groundwater pump and treatment system.
Waste Burial Area, IRP #10 (SWMU #24)	Installation of five Upper Zone monitor wells. During Stages 1 and 2 of Phase II. Geophysical survey performed during Stage 1.	Elevated levels of organic compounds found within Upper Zone.	Significant levels of organic compounds found.	Plans for RFI have been formulated, but yet to be implemented. Contaminated soil has been removed.
FDTA 1, IRP 11	Installation of two Upper Zone monitor wells and one hand auger boring during Stage 1 of Phase II investigation. Geophysical survey performed during Stage 1.	Very low levels of organic compounds found in the groundwater.	Very low levels of organic compounds found.	Site was given a no further action status following Stage 1 investigation.

Table 4.0-1. Summary of Remediation Projects at AFP4 and CAFB (Continued, Page 7 of 8)

Site Identification	Assessment Activities	Groundwater Results	Soil Results	Project Status
AFP4				
FDTA 2, IRP #12 (SWMUs #19, 20, 21)	Installation of 10 Upper Zone and one Paluxy aquifer monitor wells during Stages 1 and 2 of Phase II investigation. Shallow hand auger borings and geophysical surveys were performed during Stage 1.	Groundwater in the Upper Zone impacted with halogenated and aromatic organic compounds. Higher concentrations found downgradient of site.	Soil showed significant levels of halogenated aromatic compounds.	Plans have been formulated for RFI investigation, but have yet to be implemented. Interim remedial action has been taken in the form of excavation of 5,700 yd^3 of soil for onsite treatment.
Flightline Drainage Ditch, IRP #13 (SWMU #53)	Collection of 10 soil and sediment samples.	Not applicable.	Oil and grease were detected in significant concentrations in soil and stream sediment.	RFI Work Plan has been formulated, but yet to be implemented. 700 yd^3 of contaminated soil has been excavated for treatment.
Entomology Dry Well, IRP #15	Installation of three Upper Zone monitor wells during Stage 1 and the performance of 3 hand auger borings during Stage 2 of Phase II investigation.	No impacts were found.	No impacts were found.	RFI Work Plan has been formulated, but has yet to be implemented.
Unnamed Stream, IRP #16	Phase II investigation included collection of soil and groundwater samples from borings placed along stream and near oil/water separator. Surface water samples were also collected.	Significant organic contamination detected in surface water and shallow groundwater.	Significant organic contamination detected in soil.	RFI plan has been formulated, but has yet to be implemented.

Table 4.0-1. Summary of Remediation Projects at AFP4 and CAFB (Continued, Page 8 of 8)

Site Identification	Assessment Activities	Groundwater Results	Soil Results	Project Status
AFP4				
POL Tank Farm, IRP #17 (SWMU #68)	Collection of groundwater and soil from seven boring and five Upper Zone monitor wells during Stages 1 and 2 of Phase II investigation.	Groundwater showed significant concentrations of organic compounds. Free product was encountered in one boring.	Significant concentrations of organic compounds found.	RFI plan has been formulated, but has yet to be implemented. A skimmer has been installed to remove free product.
Weapons Storage Area	Installation of 12 borings during Stages 1 and 2 of Phase II investigation to test soil and groundwater of the Upper Zone aquifer.	Groundwater showed significant concentrations of radium.	Soil showed significant concentrations of organic compounds.	RFI has been formulated, but has yet to be implemented.
Base Service Station	Stage 2 of Phase II investigation included collection of soil and groundwater from four Upper Zone borings. A soil gas survey was also performed.	Groundwater showed elevated levels of VOCs and metals.	Soil showed elevated levels of VOCs and metals.	RFI has been formulated, but has yet to be implemented.

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